
PORTSIM Verification Summary Report

**Decision and Information
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Argonne National Laboratory**



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PORTSIM Verification Summary Report

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ABSTRACT

This summary report is a compilation of six reports previously released on the verification efforts for the Port Simulation (PORTSIM) model, a discrete-event simulation model used for analyzing military seaport operations for embarkation. In addition to describing the PORTSIM verification efforts, the report also comments on the entire verification process, including an overview of the findings. The six verification reports correspond to the six combinations of cargo types-transportation modes modeled in PORTSIM. For each of the six studies, a simplified scenario and force file (i.e., cargo list) were created and implemented to facilitate verification of basic timing data. The patterns and logic used to compute the timing data were identified and quantified and are included for each of the six reports, along with details on scenario setup parameters. The verification efforts confirmed the accuracy of simulation output results and added greater levels of quality, confidence, and usefulness to PORTSIM. These efforts improved the model and user interface, uncovered and corrected numerous bugs and anomalies, and provided insights into model behaviors and relationships.

1 INTRODUCTION

This report integrates and summarizes the PORTSIM model verification efforts described previously in a sequence of six independent interim reports released over a two-year investigation. The six verification reports correspond to the six combinations of cargo types-transportation modes in PORTSIM listed below:

- Interim PORTSIM Verification Findings [Vehicles via Convoys] (Davidson and VanKuiken, 2000c);
- PORTSIM Verification Findings: Vehicles via Flatcars (Davidson et al., 2000a);
- PORTSIM Verification Findings: Containers via Flatbed Trucks (Davidson et al., 2001d);
- PORTSIM Verification Findings: Helicopters, Residual Equipment, and Watercraft (Davidson et al., 2001c);
- PORTSIM Verification Findings: Vehicles via Flatbed Trucks (Davidson et al., 2001a); and

- PORTSIM Verification Findings: Containers via Flatcars (Davidson et al., 2002).

This compilation report summarizes the approach, findings, and conclusions from each of the individual reports.

1.1 BACKGROUND

PORTSIM is a discrete-event simulation model that allows for a comprehensive analysis of all critical seaport operations for embarkation. Applicable to ports worldwide, PORTSIM models all cargo items, ships, and port infrastructure resources as individual objects. Cargo is simulated from the time it arrives at a port to the time it is loaded onto a ship.

The verification efforts described in this report pertain to various releases of PORTSIM 3 and 4. Continuing efforts are underway to develop PORTSIM 5, which will include debarkation activities in addition to embarkation activities (Davidson et al., 2001b).

PORTSIM was developed and is under continued development by Argonne National Laboratory's Decision and Information Sciences Division for the U.S. Department of Defense Military Traffic Management Command Transportation Engineering Agency.

1.2 MOTIVATION

The verification reports emphasized the verification and correction of internal logic, processes, and interfaces. Model inputs, computations, and outputs were reviewed. Findings from the verification reports aided in debugging PORTSIM and also yielded step-by-step guidelines for understanding details of the Cargo Report. Patterns in timing milestones (displayed in Cargo Reports and Rail Timing Files) were traced, verified, and summarized in the individual verification reports (Davidson et al., 2001b).

1.3 PERSPECTIVE

To put these efforts in the context of other relevant work and literature, the following excerpts from four papers are included for reference. Hartley (1997) defined verification as “[t]he process of determining that a model implementation accurately represents the developer's conceptual description and specifications.” More simply, “Does it do what it is supposed to do?” According to Sargent (1999), “Model verification is often defined as ‘ensuring that the computer program of the computerized model and its implementation are correct.’” In addition, Sargent stated, “The primary techniques used to determine that the model has been programmed correctly are structured walk-throughs and traces.” Balci (1997) said, “Model verification is substantiating that the model is transformed from one form into another, as intended, with sufficient accuracy. Model verification deals with building the model *right*. The accuracy of transforming a problem formulation into a model specification or the accuracy of converting a model representation in micro flowchart form to an

executable computer program is evaluated in model verification.” Finally, Kleijnen (1995) stated, “Verification is determining that a simulation computer program performs as intended, i.e., debugging the computer program.”

The efforts reported in the six verification reports follow the themes and definitions of these citations. The objective was to verify that the software functioned as designed, based on methodical reviews and tests with scenarios that had predictable outcomes. As a by-product of the reviews, mathematical patterns and relationships in cargo timing results were quantified and are reported in this compilation. These relationships can prove helpful to the user in confirming and verifying outcomes from new scenarios and assumptions (Davidson et al., 2001b).

1.4 PORTSIM UPDATES AND UPGRADES DURING THE STUDY

Because the analyses and reports were developed over approximately two years, subtle differences are apparent among the reports. These differences are due in part to changes in the PORTSIM model (new versions releases, updates, and upgrades over the study period). In addition, some formatting conventions evolved in each report as the analysis progressed. Finally, each report was customized to fit the PORTSIM reports corresponding to the cargo-transport pathway under investigation (Davidson et al., 2001b).

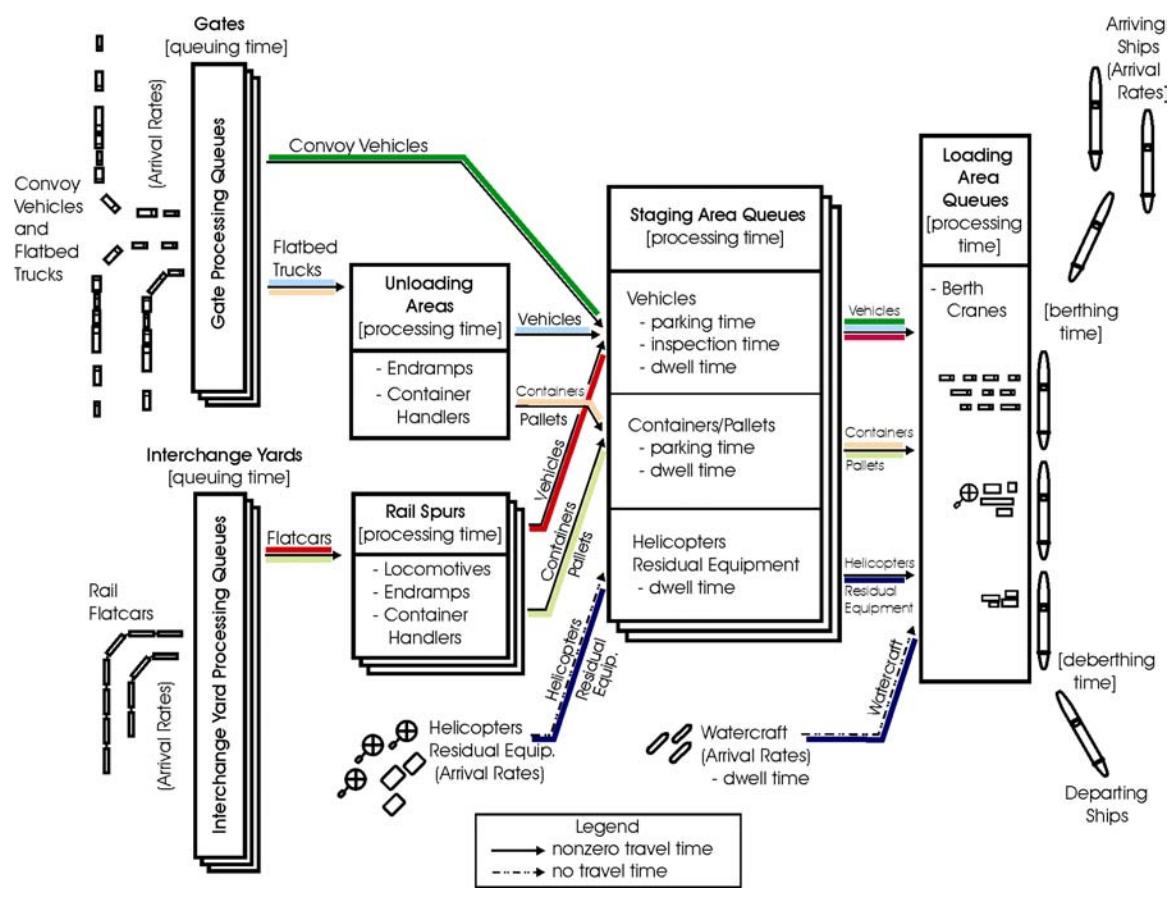
Table 1 summarizes the sequence of interim reports and corresponding PORTSIM versions.

TABLE 1 PORTSIM Versions Corresponding to Each of the Six Verification Reports

Verification Report	Report Date	PORTSIM Version
Interim PORTSIM Verification Findings [Vehicles via Convoys]	5/19/2000	3.61
PORTSIM Verification Findings: Vehicles via Flatcars	12/20/2000	4.0
PORTSIM Verification Findings: Containers via Flatbed Trucks	4/13/2001	4.2
PORTSIM Verification Findings: Helicopters, Residual Equipment, and Watercraft	8/30/2001	4.3
PORTSIM Verification Findings: Vehicles via Flatbed Trucks	11/16/2001	4.3
PORTSIM Verification Findings: Containers via Flatcars	2/22/2002	4.4

1.5 SIX PATHWAYS

Figure 1 illustrates the queues, processes, and flows represented in PORTSIM. In a simulation, various types of cargo arrive at a port; proceed through handling, staging, and inspection processes; and are loaded onto ships. Depending on the cargo type and transportation mode (e.g., vehicles can arrive via convoys, flatbed trucks, or rail flatcars), cargo takes different pathways through these processes (Davidson et al., 2001b). Specifically, PORTSIM consists of six cargo-transport pathways. In the figure, each pathway is highlighted in a different color and has a corresponding verification report.



Cargo Type - Transportation Mode

- Vehicles via Convoys
- Vehicles via Flatcars
- Containers via Flatbed Trucks
- Helicopters, Residual Equipment, and Watercraft
- Vehicles via Flatbed Trucks
- Containers via Flatcars

Color Mapping

- Dark green
- Red
- Orange
- Dark blue
- Light blue
- Light green

FIGURE 1 The Six Cargo-Transport Pathways in PORTSIM

2 APPROACH

2.1 SCENARIO DEFINITIONS

For each of the six studies, a small scenario and a small force file were created and implemented to facilitate verification of basic queuing logic. The scenario was set up to use one gate, one staging area, one berth, one interchange yard, and one spur at the Port of Savannah (Garden City Terminal). Each of the six force files contained 100 identical cargo items with the exception of the Helicopters, Residual Equipment, and Watercraft study, which used five each of the three respective cargo items. To simplify the analysis, initial tests treated all variables deterministically (e.g., cargo arrival, timing parameters, and ship arrival). Minor exceptions to this procedure were the two earliest studies — Vehicles via Convoys and Vehicles via Flatcars — in which PORTSIM could only be set up stochastically for cargo arriving at port. Sections 2.1.1–2.1.6 provide more details on the scenario setups. See *PORTSIM v.4.3: User's Manual* (Davidson et al., 2001b) for a discussion of deterministic and stochastic options for PORTSIM.

2.1.1 Summary of Scenario Inputs for Vehicles via Convoys

This section summarizes the inputs used in the scenario **basecv.rd** (Davidson and VanKuiken, 2000c).

Scenario name: **basecv.rd**

Force file name: **convoy1.lst** (100 identical convoy vehicles)

Time to simulate: 500 hours

Locomotives: 1

End ramps: 1

Docks: 6

Inspectors: 200

Drivers: 200

Container handlers: 1

Gates: #1, only one available for military use

Inbound lanes: 2

Outbound lanes: 2

Gate can accept: all types (convoys vehicle, flatbed trucks, vans)

Berths: #4, only one available for military use

Length: 1,200 feet

Container cranes: 1

Wharf cranes: 1

Open staging: #1, only one available for military use
 Capacity of military use: 833,105 square feet
 Percent usable for staging: 60% (499,863 square feet)
 Stacking height for containers: 3
 Type of cargo handled: all types (wheeled vehicles, tracked vehicles, containers)

Interchange yard: #1, only one available for military use
 Capacity: 208 railcars
 Percent usable: 60% (125 railcars)

Spurs: #1, only one available for military use
 Type: open staging
 Tangent length: 1,416 feet
 Offloading method: end ramps
 Loading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one
 (SD = standard deviation)

Vehicle:	SD = 0	<i>(deterministic port operations)</i>
Container:	SD = 0	<i>(deterministic port operations)</i>
Railcar:	SD = 0	<i>(deterministic port operations)</i>
Pallets:	SD = 0	<i>(deterministic port operations)</i>
Ship:	SD = 0	<i>(deterministic port operations)</i>
Flatbed:	SD = 0	<i>(deterministic port operations)</i>
Van:	SD = 0	<i>(deterministic port operations)</i>

Arrival mode time parameters:

Convoy vehicles:	Exponential	20 per convoy/0 start arriving/30 min between arrivals <i>(stochastic cargo arrival)</i>
Flatbeds:	Exponential	20/0/40 min.
Vans:	Exponential	20/0/80 min.
Ships:	Exponential	-/-
Trains:	Exponential	50/0/5 hours

Sizes of groups for arrivals at the port:

Vehicles per convoy:	25
Commercial highway – number of flatbeds per group:	1
Commercial highway – number of vans per group:	1
Commercial rail – number of railcars per train:	50

Ship 1: *Adm Wm M Callaghan*

Length:	694 feet
Maximum capacities by cargo type:	
Breakbulk:	0
Container:	0

Roll-on/roll-off (RORO): 168,000
Maximum wait without loading/offloading: 6 hours
Ship arrival time to port: 5 hours *(deterministic ship arrival)*

Ship 2: *Adabella Lykes*
Length: 660 feet
Maximum capacities by cargo type:
Breakbulk: 0
Container: 7,155 square feet
RORO: 0
Maximum wait without loading/offloading: 6 hours
Ship arrival time to port: 5 hours *(deterministic ship arrival)*

2.1.2 Summary of Scenario Inputs for Vehicles via Flatcars

This section summarizes the inputs used in the scenario **basecvr.rd** (Davidson et al., 2000a).

Scenario name: **basecvr.rd**
Force file name: **cvrail1.lst** (100 identical convoy vehicles on fifty 60-foot flatcars)

Time to simulate: 50 hours

Locomotives: 1
Docks: 6
End ramps: 1
Drivers: 200
Inspectors: 200
Stevedores: 30
Container handlers: 1

Gates: #1, only one available for military use
Gate can accept: all types (convoys vehicle, flatbed trucks, vans)

Open staging: #1, only one available for military use
Capacity of military use: 833,105 square feet
Percent usable for staging: 60% (499,863 square feet)
Stacking height for containers: 3
Type of cargo handled: all types (wheeled vehicles, tracked vehicles, containers)

Berths: #4, only one available for military use
Length: 1,200 feet
Container cranes: 1
Wharf cranes: 1
Maximum call forward: 12

Interchange yard: #1, only one available for military use
Capacity: 208 railcars
Percent usable: 60% (125 railcars)

Spurs: #1, only one available for military use
Type: open staging
Tangent length: 1,416 feet
Vehicle offloading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one
Vehicle: range = 0 *(deterministic port operations)*
Railcar: range = 0 *(deterministic port operations)*
Ship: range = 0 *(deterministic port operations)*

Arrival mode time parameters:
Ships: Exponential *(deterministic ship arrival)*
Trains: Exponential *(stochastic cargo arrival)*

Ship 1: *Adm Wm M Callaghan*
Length: 694 feet
Maximum capacities by cargo type:
Breakbulk: 0
Container: 0
RORO: 168,000
Maximum wait without loading/offloading: 6 hours
Ship arrival time to port: 5 hours *(deterministic ship arrival)*

Ship 2: *Adabella Lykes*
Length: 660 feet
Maximum capacities by cargo type:
Breakbulk: 0
Container: 7,155 square feet
RORO: 0
Maximum wait without loading/offloading: 6 hours
Ship arrival time to port: 5 hours *(deterministic ship arrival)*

2.1.3 Summary of Scenario Inputs for Containers via Flatbed Trucks

This section summarizes the inputs used in the scenario **basecont_truck.rd** (Davidson et al., 2001d).

Scenario name: **basecont_truck.rd**
Force file name: **cont_truck.lst** (100 identical containers on fifty 40-ft flatbed trucks)

Time to simulate: 50 hours

Locomotives: 1
Docks: 6
End ramps: 1
Drivers: 200
Inspectors: 200
Stevedores: 30
Container handlers: 30

Gates: #1, only one available for military use
Gate can accept: all types (convoy vehicles and flatbed trucks)

Open staging: #1, only one available for military use
Capacity of military use: 833,105 square feet
Percent usable for staging: 60% (499,863 square feet)
Stacking height for containers: 3
Type of cargo handled: all types (wheeled vehicles, tracked vehicles, containers)

Berths: #4, only one available for military use
Length: 1,200 feet
Container cranes: 1
Wharf cranes: 1
Maximum call forward: 12

Interchange yard: #1, only one available for military use
Capacity: 208 railcars
Percent usable: 60% (125 railcars)

Spurs: #1, only one available for military use
Type: open staging
Tangent length: 1,416 feet
Vehicle offloading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one
Containers: range = 0 *(deterministic port operations)*
Flatbeds: range = 0 *(deterministic port operations)*
Ship: range = 0 *(deterministic port operations)*

Arrival mode time parameters:
Flatbeds: fixed arrival rate, 20 flatbeds *(deterministic cargo arrival)*
per group every 40 minutes

Ship 1: *Chesapeake Bay*
Length: 663 feet

Maximum capacities by cargo type:

Breakbulk: 0

Container: 345,075 square feet

RORO: 0

Maximum wait without loading/offloading: 6 hours

Ship arrival time to port: 5 hours

(deterministic ship arrival)

2.1.4 Summary of Scenario Inputs for Helicopters, Residual Equipment, and Watercraft

This section summarizes the inputs used in the scenario **heli_res_wat.rd** (Davidson et al., 2001c).

Scenario name: **heli_res_wat.rd**

Force file name: **heli_res_wat.lst** (5 helicopters, 5 pieces of residual equipment, and 5 watercraft)

Time to simulate: 100 hours

Locomotives: 1

End ramps: 2

Drivers: 200

Inspectors: 200

Stevedores: 30

Container handling equipment: 30

Gates: #1, only one available for military use

Gate can accept: all types (convoy vehicles and flatbed trucks)

Open staging: #1, only one available for military use

Capacity of military use: 2,102,031 square feet

Percent usable for staging: 60% (1,261,218 square feet)

Stacking height for containers: 4

Type of cargo handled: wheeled vehicles, tracked vehicles, and containers

Berths: #4, only one available for military use

Length: 1,200 feet

Number of cranes: 1

Maximum call forward: 12

Types of ships accepted: breakbulk, container, RORO, and barge

Interchange yard: #1, only one available for military use

Capacity: 300 railcars

Percent usable: 60% (180)

Spurs: #1, only one available for military use
Spur type: open staging
Length: 1,373 feet
Vehicle offloading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one
Helicopters: range = 0 *(deterministic port operations)*
Residual equipment: range = 0 *(deterministic port operations)*
Watercraft: range = 0 *(deterministic port operations)*
Ship: range = 0 *(deterministic port operations)*

Arrival mode time parameters:

Helicopters: deterministic arrivals, *(deterministic cargo arrival)*
1 helicopter per group every 15 minutes
Residual equipment: deterministic arrivals, *(deterministic cargo arrival)*
1 residual piece of equipment per group every 15 minutes
Watercraft: deterministic arrivals, *(deterministic cargo arrival)*
1 watercraft per group every 15 minutes

Ship 1: *Algol*

Length: 946 feet
Maximum capacities by cargo type:
Breakbulk: 0
Container: 36,000 square feet
RORO: 204,179 square feet

Maximum wait without loading before departing: 6 hours
Ship arrival time to port: 5 hours *(deterministic ship arrival)*

2.1.5 Summary of Scenario Inputs for Vehicles via Flatbed Trucks

This section summarizes the inputs used in the scenario **baseveh_truck.rd** (Davidson et al., 2001a).

Scenario name: **baseveh_truck.rd**

Force file name: **veh_truck.lst** (100 identical vehicles on fifty 40-foot flatbed trucks)

Time to simulate: 100 hours

Locomotives: 1
End ramps: 2
Drivers: 200
Inspectors: 200
Stevedores: 30
Container handling equipment: 30

Gates: #1, only one available for military use
Gate can accept: all types (convoy vehicles and flatbed trucks)

Open staging: #1, only one available for military use
Capacity of military use: 2,102,031 square feet
Percent usable for staging: 60% (1,261,219 square feet)
Stacking height for containers: 4
Type of cargo handled: wheeled vehicles, tracked vehicles, and containers

Berths: #4, only one available for military use
Length: 1,200 feet
Number of cranes: 1
Maximum call forward: 12
Types of ships accepted: breakbulk, container, RORO, and barge

Interchange yard: #1, only one available for military use
Capacity: 300 railcars
Percent usable: 60% (180 railcars)

Spurs: #1, only one available for military use
Spur type: open staging
Length: 1,373 feet
Vehicle offloading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one
Flatbeds: range = 0 *(deterministic port operations)*
Vehicles: range = 0 *(deterministic port operations)*
Ship: range = 0 *(deterministic port operations)*

Arrival mode time parameters:
Flatbeds: deterministic arrivals, *(deterministic cargo arrival)*
10 flatbeds per group every 40 minutes

Ship 1: *Algol*
Length: 946 feet
Maximum capacities by cargo type:
Breakbulk: 0
Container: 36,000 square feet
RORO: 204,179 square feet
Self-sustaining: yes
Maximum wait without loading before departing: 6 hours
Ship arrival time to port: 10 hours *(deterministic ship arrival)*

2.1.6 Summary of Scenario Inputs for Containers via Flatcars

This section summarizes the inputs used in the scenario **basecont_rail.rd** (Davidson et al., 2002).

Scenario name: **basecont_rail.rd**

Force file name: **contrail.lst** (100 identical 20-foot containers on twenty-five 89-foot flatcars)

Time to simulate: 100 hours

Locomotives: 1

End ramps: 30

Drivers: 200

Inspectors: 200

Stevedores: 30

Container handling equipment: 30

Gates: #1, only one available for military use

Gate can accept: all types (convoys, vehicles, and flatbed trucks)

Open staging: #1, only one available for military use

Capacity of military use: 2,102,031 square feet

Percent usable for staging: 60% (1,261,219 square feet)

Stacking height for containers: 4

Type of cargo handled: all types (wheeled vehicles, tracked vehicles, containers)

Berths: #4, only one available for military use

Length: 1,200 feet

Number of cranes: 1

Maximum call forward: 12

Types of ships accepted: breakbulk, container, RORO, and barge

Interchange yard: #1, only one available for military use

Capacity: 300 railcars

Percent usable: 60% (180 railcars)

Spurs: #1, only one available for military use

Type: open staging

Tangent length: 1,373 feet

Vehicle offloading method: end ramps

Process timing parameters: all times set to integers greater than or equal to one

Containers: range = 0 *(deterministic port operations)*

Railcar: range = 0 *(deterministic port operations)*

Ship: range = 0 *(deterministic port operations)*

Arrival mode time parameters:

Trains: 10 railcars per train every 5 hours (*deterministic cargo arrival*)

Ship 1: *Endurance*

Length: 595 feet

Maximum capacities by cargo type:

Breakbulk: 0

Container: 308,480 square feet

RORO: 0

Maximum wait without loading/offloading: 20 hours

Ship arrival time to port: 14 hours (*deterministic ship arrival*)

2.2 CARGO TIMING DATA

The Cargo Report and the Rail Timing File (used only for the two studies involving railcars), contain the most complete sources of cargo timing data for PORTSIM. For that reason, verification focused on confirming the timing information (for individual cargo pieces) detailed in these two reports. The Cargo Report includes information on when cargo arrives at port, clears the gate, parks in staging, is available to load, and is loaded on ships. It also includes the corresponding loading time for cargo loaded onto the ships. The Rail Timing File provides additional information for tracking flatcar movements at 10 more checkpoints, beginning with flatcar arrivals at port and continuing through operations in the interchange yard, container unloading events at the rail spur, and return of flatcars to the interchange yard.¹

By using the small scenario, with a small force file, the 100 cargo items (15 cargo items for the Helicopters, Residual Equipment, and Watercraft study) were tracked through the port from the time of arrival until the time of loading onto a ship.

To verify the timing data found in the Cargo Report and Rail Timing File, the patterns and logic used to compute each of the 15 fields of timing data for these two reports were identified and quantified. These relationships were then formulated into equations (Sections 3.2.1.2–3.2.6.2). Findings were reviewed with the PORTSIM program developer, and it was confirmed that the conclusions matched with the intended PORTSIM simulation structure and logic.

¹ The Rail Timing File is not a menu choice in the user interface and is not intended for user access. The program developer created it specifically to assist in tracking rail events for the verification efforts.

3 FINDINGS

3.1 OVERVIEW

For each of the six studies, the results confirmed that the flow of cargo through the port matched the reported timing values. That is, each piece of cargo was reported to be in the correct place at the correct time for each of the five fields of timing data in the Cargo Report and the ten fields of timing data in the Rail Timing File. The Rail Timing File applies only to the two studies involving flatcars — Vehicles via Flatcars and Containers via Flatcars.

3.2 DETAILED FINDINGS

This section includes the following supporting documents with detailed findings for each of the six combinations of cargo types and transportation modes:

- *Diagram*. The items and pathways highlighted in color are the focus of each individual report.
- *Tracking Sequence*. The equations and logic that reproduce the results of the Cargo Report and Rail Timing File.
- *Cargo Report and Rail Timing File Output*. The complete Cargo Report and Rail Timing File of the scenario and force file (annotated to identify the timing patterns).
- *Screen Capture of Input Windows*. The screen capture of the input windows (inputs used to compute the Cargo Report and Rail Timing File).
- *PORTSIM Menu Inputs*. The menu choices/path to the windows where users enter input values (used to compute the Cargo Report and Rail Timing File).

3.2.1 Vehicles via Convoys

3.2.1.1 Diagram of Vehicles via Convoys

Figure 2 shows the pathway of vehicles via convoys.

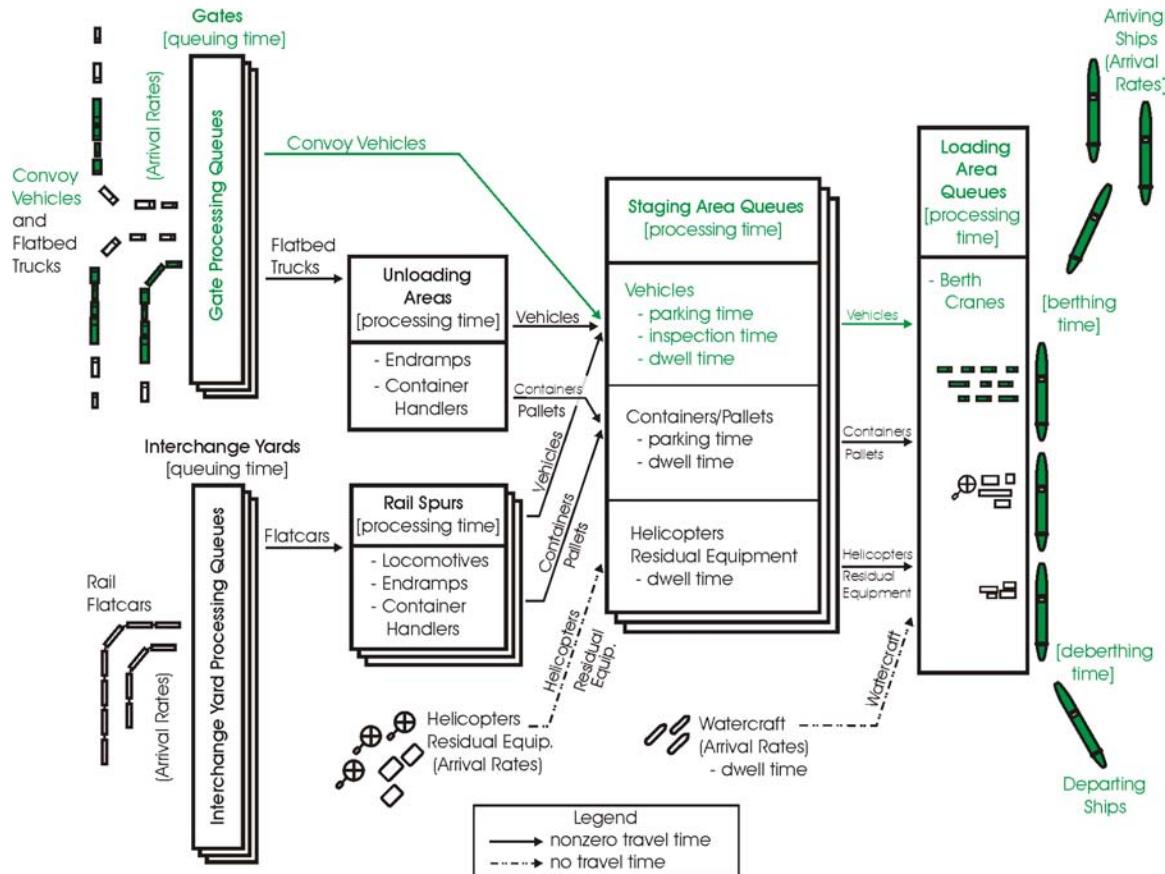


FIGURE 2 Pathway of Vehicles via Convoys

3.2.1.2 Tracking Sequence for Vehicles via Convoys

This section presents the equations and logic that reproduce the results of the Cargo Report for the **basecv.rd** scenario using the **convoy1.lst** force file. First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report. The order presented follows the order of the Cargo Report columns from left to right.

The following example shows how to compute the Time Cleared Gate (TCG) for the first and second vehicles from the Cargo Report. The TCG of the first vehicle is equal to the time it arrived at port plus the time required for gate processing for vehicles. The TCG of the second vehicle is equal to the previous results plus the time for gate processing for vehicles.

Section 3.2.1.4 contains a screen capture of the window for setting gate processing for vehicles and all other defined input variables a...k used in this section.

Projections for formulating the timing data for larger scenarios are also included. In general, with large and/or more complex scenarios, TCG and Time Loaded (TL) would change the most, while the other parameters (i.e., Time Arrived at Port [TAP], Time Parked in Staging [TPS], Time Available to Load [TAL], and Loading Rate [LR]) would generally remain stable.

Notation

- N = total number of cargo pieces in the force
- $m \in 1, 2 \dots N$
- $a \dots k$ = input variables used in PORTSIM
- \wedge = results from previous step (i.e., from the previous cargo item within the same column of the Cargo Report)

Time Arrived at Port = TAP = $f(a, b, c)$

- a = Number of Vehicles per Convoy
- b = Time to Begin Simulating Arrivals
- c = Average Time Between Arrivals

Convoys arrive at the port in groups of "a" vehicles, with the first group arriving at time "b." The time separation between convoys is equal to "c" minutes.

For large scenarios, projections support that the TAP is the same or similar even when many convoys arrive at port at the same or about the same time.

Time Cleared Gate = TCG = $f(TAP, d)$

- d = Gate Processing

$$\begin{aligned} TCG_1 &= TAP_1 + d \\ TCG_2 &= \wedge + d \\ TCG_3 &= \wedge + d \\ &\dots \end{aligned}$$

Except for instances where $TAP_{m+1} > TCG_m$ occur (i.e., waiting times between the last vehicle of a convoy clearing the gate and the next convoy arriving), use the following:

$$\begin{aligned} TCG_{m+1} &= TAP_{m+1} + d \\ TCG_{m+2} &= \wedge + d \\ TCG_{m+3} &= \wedge + d \\ &\dots \end{aligned}$$

For example, between the second and third convoy in the **basecv.rd** scenario, where:

$$\begin{aligned} TAP_{41} &> TCG_{40} \quad (TAP_{41} = :54, d = :01) \\ TCG_{41} &= TAP_{41} + d = :54 + :01 = :55 \\ TCG_{42} &= :56 \\ TCG_{43} &= :57 \end{aligned}$$

For large scenarios, projections show that TCG could experience delays because cargo is not allowed to go through the gate unless the staging areas have sufficient space to accommodate that cargo.

For convoys, all vehicles in a convoy are processed together. If the staging area has enough space to accommodate only a fraction of the vehicles in the convoy, those vehicles do not proceed through the gate. Rather, they must wait until space becomes available for the entire convoy. Other types of vehicles are allowed to process through the gate even when vehicles are waiting for space for the entire convoy.

Time Parked in Staging = TPS = $f(TCG, e, f)$

$$\begin{aligned} e &= \text{Transit Vehicle Gate to Open Staging} \\ f &= \text{Open Staging Parking} \end{aligned}$$

$$\begin{aligned} TPS_1 &= TCG_1 + e + f \\ TPS_2 &= TCG_2 + e + f \\ \dots \\ TPS_n &= TCG_n + e + f \end{aligned}$$

For large scenarios, projections show that TPS remains the same or similar.

Time Available to Load = TAL = $f(TPS, g)$

$$g = \text{Open Staging Inspection}$$

$$\begin{aligned} TAL_1 &= TPS_1 + g \\ TAL_2 &= TPS_2 + g \\ \dots \\ TAL_n &= TPS_n + g \end{aligned}$$

For large scenarios, projections show that the TAL will experience delays when it is necessary to wait for cargo to be inspected (e.g., for small number of inspectors).

Time Loaded = TL = $f(h, i, j, k)$

$$\begin{aligned} h &= \text{Transit Vehicle to Berth} \\ i &= \text{Load Vehicle at RORO Berth} \\ j &= \text{Ship Berthing Time} \\ k &= \text{Ship Arrival Time to Port} \end{aligned}$$

For $TAL_1 \geq j + k$
 $TL_1 = h + i + j + k$
 $TL_2 = ^\wedge + i$
 $TL_3 = ^\wedge + i$
 ...

Other Factors Affecting Time Loaded (Depth)

l = Maximum Call Forward, the number of drivers available at a time to move convoy vehicles from the staging area to the berth. This number affects the Time Loaded by loading the convoy vehicles in groups equal to the Maximum Call Forward.

$h + i + 5$ = time needed to bus drivers from a berth to a staging area for every l (Maximum Call Forward) convoy vehicle.

Note that the TL becomes untraceable when Ship Berthing Time = 0, and Ship Arrival Time to Port = 0.

For large scenarios, projections show that the TL could be different because of several possible conditions (e.g., waiting for RORO ship to berth, loading more than one ship at a time, force file containing a mixture of cargo [convoys and containers], cargo arriving through more than one gate, etc.).

Loading Rate = LR = $f(i)$

i = Load Vehicle at RORO Berth

$LR_1 = i$
 $LR_2 = i$
 ...
 $LR_n = i$

For large scenarios, projections show that the LR will change depending on the type of ship that is being loaded; however, even with different ship types in the scenario, the LR will be very easy to compute.

3.2.1.3 Cargo Report Output for Vehicles via Convoys

This section contains a printout of the Cargo Report for the **basecv.rd** scenario using the **convoy1.lst** force file. The equations from Section 3.2.1.2 are written in some of the cells of the Cargo Report.

PORTSIM Detailed Cargo Report

(Note: All Times Are Represented In DDD:HH:MM)

Sort Instructions: To sort on a desired column, double-click the column header and the table will be sorted by that column.

20

LIN ID	TAP		TCG		TPS		TAL		TL		LR (Mins)	Ship Loaded Onto
	Time Arrived At Port	TAP ₁	Time Cleared Gate	TCG _{1+d}	0:00:08	TPC _{1+e+f}	0:00:33	TPS _{1+g}	0:08:06	h+i+j+k	4	
KNICK 1VE000000001	0:00:00	TAP ₁	0:00:01	TCG _{1+d}	0:00:08	TPC _{1+e+f}	0:00:33	TPS _{1+g}	0:08:06	h+i+j+k	4	Adm Wm M Callaghan
KNICK 1VE000000002	0:00:00	TAP ₂	0:00:02	^+d	0:00:09	TCG _{2+e+f}	0:00:34	TPS _{2+g}	0:08:10	^+i	4	Adm Wm M Callaghan
KNICK 1VE000000003	0:00:00	TAP ₃	0:00:03	^+d	0:00:10	TCG _{3+e+f}	0:00:35	TPS _{3+g}	0:08:14	^+i	4	Adm Wm M Callaghan
KNICK 1VE000000004	0:00:00	.	0:00:04	.	0:00:11	.	0:00:36	.	0:08:18	.	4	Adm Wm M Callaghan
KNICK 1VE000000005	0:00:00	.	0:00:05	.	0:00:12	.	0:00:37	.	0:08:22	.	4	Adm Wm M Callaghan
KNICK 1VE000000006	0:00:00	.	0:00:06	.	0:00:13	.	0:00:38	.	0:08:26	.	4	Adm Wm M Callaghan
KNICK 1VE000000007	0:00:00		0:00:07		0:00:14		0:00:39		0:08:30		4	Adm Wm M Callaghan
KNICK 1VE000000008	0:00:00		0:00:08		0:00:15		0:00:40		0:08:34		4	Adm Wm M Callaghan
KNICK 1VE000000009	0:00:00		0:00:09		0:00:16		0:00:41		0:08:38		4	Adm Wm M Callaghan
KNICK 1VE000000010	0:00:00		0:00:10		0:00:17		0:00:42		0:08:42		4	Adm Wm M Callaghan
KNICK 1VE000000011	0:00:00		0:00:11		0:00:18		0:00:43		0:08:46		4	Adm Wm M Callaghan
KNICK 1VE000000012	0:00:00		0:00:12		0:00:19		0:00:44		0:08:50		4	Adm Wm M Callaghan
KNICK 1VE000000013	0:00:00		0:00:13		0:00:20		0:00:45		0:09:01		4	Adm Wm M Callaghan
KNICK 1VE000000014	0:00:00		0:00:14		0:00:21		0:00:46		0:09:05		4	Adm Wm M Callaghan
KNICK 1VE000000015	0:00:00		0:00:15		0:00:22		0:00:47		0:09:09		4	Adm Wm M Callaghan
KNICK 1VE000000016	0:00:00		0:00:16		0:00:23		0:00:48		0:09:13		4	Adm Wm M Callaghan
KNICK 1VE000000017	0:00:00		0:00:17		0:00:24		0:00:49		0:09:17		4	Adm Wm M Callaghan
KNICK 1VE000000018	0:00:00		0:00:18		0:00:25		0:00:50		0:09:21		4	Adm Wm M Callaghan
KNICK 1VE000000019	0:00:00		0:00:19		0:00:26		0:00:51		0:09:25		4	Adm Wm M Callaghan
KNICK 1VE000000020	0:00:00		0:00:20		0:00:27		0:00:52		0:09:29		4	Adm Wm M Callaghan
KNICK 1VE000000021	0:00:02		0:00:21		0:00:28		0:00:53		0:09:33		4	Adm Wm M Callaghan
KNICK 1VE000000022	0:00:02		0:00:22		0:00:29		0:00:54		0:09:37		4	Adm Wm M Callaghan
KNICK 1VE000000023	0:00:02		0:00:23		0:00:30		0:00:55		0:09:41		4	Adm Wm M Callaghan
KNICK 1VE000000024	0:00:02		0:00:24		0:00:31		0:00:56		0:09:45		4	Adm Wm M Callaghan
KNICK 1VE000000025	0:00:02		0:00:25		0:00:32		0:00:57		0:09:56		4	Adm Wm M Callaghan
KNICK 1VE000000026	0:00:02		0:00:26		0:00:33		0:00:58		0:10:00		4	Adm Wm M Callaghan
KNICK 1VE000000027	0:00:02		0:00:27		0:00:34		0:00:59		0:10:04		4	Adm Wm M Callaghan
KNICK 1VE000000028	0:00:02		0:00:28		0:00:35		0:01:00		0:10:08		4	Adm Wm M Callaghan
KNICK 1VE000000029	0:00:02		0:00:29		0:00:36		0:01:01		0:10:12		4	Adm Wm M Callaghan
KNICK 1VE000000030	0:00:02		0:00:30		0:00:37		0:01:02		0:10:16		4	Adm Wm M Callaghan

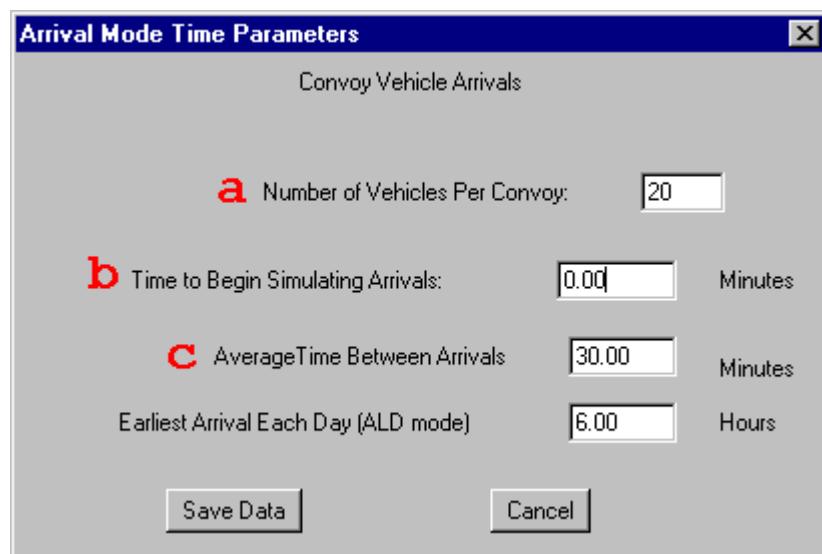
a b c h+i+5

KNICK 1VE00000031	0:00:02	0:00:31	0:00:38	0:01:03	0:10:20	4	1	Adm Wm M Callaghan	
KNICK 1VE00000032	0:00:02	0:00:32	0:00:39	0:01:04	0:10:24	4		Adm Wm M Callaghan	
KNICK 1VE00000033	0:00:02	0:00:33	0:00:40	0:01:05	0:10:28	4		Adm Wm M Callaghan	
KNICK 1VE00000034	0:00:02	0:00:34	0:00:41	0:01:06	0:10:32	4		Adm Wm M Callaghan	
KNICK 1VE00000035	0:00:02	0:00:35	0:00:42	0:01:07	0:10:36	4		Adm Wm M Callaghan	
KNICK 1VE00000036	0:00:02	0:00:36	0:00:43	0:01:08	0:10:40	4		Adm Wm M Callaghan	
KNICK 1VE00000037	0:00:02	0:00:37	0:00:44	0:01:09	0:10:51	4		Adm Wm M Callaghan	
KNICK 1VE00000038	0:00:02	0:00:38	0:00:45	0:01:10	0:10:55	4		Adm Wm M Callaghan	
KNICK 1VE00000039	0:00:02	0:00:39	0:00:46	0:01:11	0:10:59	4		Adm Wm M Callaghan	
KNICK 1VE00000040	0:00:02	0:00:40	0:00:47	0:01:12	0:11:03	4		Adm Wm M Callaghan	
KNICK 1VE00000041	0:00:54	TAP ₄₁	0:00:55	TAP _{41+d}	0:01:02	0:01:27	0:11:07	4	Adm Wm M Callaghan
KNICK 1VE00000042	0:00:54		0:00:56	^+d	0:01:03	0:01:28	0:11:11	4	Adm Wm M Callaghan
KNICK 1VE00000043	0:00:54		0:00:57	^+d	0:01:04	0:01:29	0:11:15	4	1 Adm Wm M Callaghan
KNICK 1VE00000044	0:00:54		0:00:58	.	0:01:05	0:01:30	0:11:19	4	Adm Wm M Callaghan
KNICK 1VE00000045	0:00:54		0:00:59	.	0:01:06	0:01:31	0:11:23	4	Adm Wm M Callaghan
KNICK 1VE00000046	0:00:54		0:01:00	.	0:01:07	0:01:32	0:11:27	4	Adm Wm M Callaghan
KNICK 1VE00000047	0:00:54		0:01:01		0:01:08	0:01:33	0:11:31	4	Adm Wm M Callaghan
KNICK 1VE00000048	0:00:54		0:01:02		0:01:09	0:01:34	0:11:35	4	Adm Wm M Callaghan
KNICK 1VE00000049	0:00:54		0:01:03		0:01:10	0:01:35	0:11:46	4	1 Adm Wm M Callaghan
KNICK 1VE00000050	0:00:54		0:01:04		0:01:11	0:01:36	0:11:50	4	Adm Wm M Callaghan
KNICK 1VE00000051	0:00:54		0:01:05		0:01:12	0:01:37	0:11:54	4	Adm Wm M Callaghan
KNICK 1VE00000052	0:00:54		0:01:06		0:01:13	0:01:38	0:11:58	4	Adm Wm M Callaghan
KNICK 1VE00000053	0:00:54		0:01:07		0:01:14	0:01:39	0:12:02	4	Adm Wm M Callaghan
KNICK 1VE00000054	0:00:54		0:01:08		0:01:15	0:01:40	0:12:06	4	Adm Wm M Callaghan
KNICK 1VE00000055	0:00:54		0:01:09		0:01:16	0:01:41	0:12:10	4	1 Adm Wm M Callaghan
KNICK 1VE00000056	0:00:54		0:01:10		0:01:17	0:01:42	0:12:14	4	Adm Wm M Callaghan
KNICK 1VE00000057	0:00:54		0:01:11		0:01:18	0:01:43	0:12:18	4	Adm Wm M Callaghan
KNICK 1VE00000058	0:00:54		0:01:12		0:01:19	0:01:44	0:12:22	4	Adm Wm M Callaghan
KNICK 1VE00000059	0:00:54		0:01:13		0:01:20	0:01:45	0:12:26	4	Adm Wm M Callaghan
KNICK 1VE00000060	0:00:54		0:01:14	c	0:01:21	0:01:46	0:12:30	4	1 Adm Wm M Callaghan
KNICK 1VE00000061	0:01:37		0:01:38	c	0:01:45	0:02:10	0:12:41	4	Adm Wm M Callaghan
KNICK 1VE00000062	0:01:37		0:01:39		0:01:46	0:02:11	0:12:45	4	Adm Wm M Callaghan
KNICK 1VE00000063	0:01:37		0:01:40		0:01:47	0:02:12	0:12:49	4	Adm Wm M Callaghan
KNICK 1VE00000064	0:01:37		0:01:41		0:01:48	0:02:13	0:12:53	4	Adm Wm M Callaghan
KNICK 1VE00000065	0:01:37		0:01:42		0:01:49	0:02:14	0:12:57	4	Adm Wm M Callaghan
KNICK 1VE00000066	0:01:37		0:01:43		0:01:50	0:02:15	0:13:01	4	Adm Wm M Callaghan
KNICK 1VE00000067	0:01:37		0:01:44		0:01:51	0:02:16	0:13:05	4	1 Adm Wm M Callaghan
KNICK 1VE00000068	0:01:37		0:01:45		0:01:52	0:02:17	0:13:09	4	Adm Wm M Callaghan
KNICK 1VE00000069	0:01:37		0:01:46		0:01:53	0:02:18	0:13:13	4	Adm Wm M Callaghan
KNICK 1VE00000070	0:01:37		0:01:47		0:01:54	0:02:19	0:13:17	4	Adm Wm M Callaghan
KNICK 1VE00000071	0:01:37		0:01:48		0:01:55	0:02:20	0:13:21	4	Adm Wm M Callaghan

KNICK 1VE00000072	0:01:37	0:01:49	0:01:56	0:02:21	0:13:25	4	h+i+5	Adm Wm M Callaghan
KNICK 1VE00000073	0:01:37	0:01:50	0:01:57	0:02:22	0:13:36	4		Adm Wm M Callaghan
KNICK 1VE00000074	0:01:37	0:01:51	0:01:58	0:02:23	0:13:40	4		Adm Wm M Callaghan
KNICK 1VE00000075	0:01:37	0:01:52	0:01:59	0:02:24	0:13:44	4		Adm Wm M Callaghan
KNICK 1VE00000076	0:01:37	0:01:53	0:02:00	0:02:25	0:13:48	4		Adm Wm M Callaghan
KNICK 1VE00000077	0:01:37	0:01:54	0:02:01	0:02:26	0:13:52	4		Adm Wm M Callaghan
KNICK 1VE00000078	0:01:37	0:01:55	0:02:02	0:02:27	0:13:56	4		Adm Wm M Callaghan
KNICK 1VE00000079	0:01:37	0:01:56	0:02:03	0:02:28	0:14:00	4	I	Adm Wm M Callaghan
KNICK 1VE00000080	0:01:37	0:01:57	0:02:04	0:02:29	0:14:04	4		Adm Wm M Callaghan
KNICK 1VE00000081	0:01:37	0:01:58	0:02:05	0:02:30	0:14:08	4		Adm Wm M Callaghan
KNICK 1VE00000082	0:01:37	0:01:59	0:02:06	0:02:31	0:14:12	4		Adm Wm M Callaghan
KNICK 1VE00000083	0:01:37	0:02:00	0:02:07	0:02:32	0:14:16	4		Adm Wm M Callaghan
KNICK 1VE00000084	0:01:37	0:02:01	0:02:08	0:02:33	0:14:20	4	h+i+5	Adm Wm M Callaghan
KNICK 1VE00000085	0:01:37	0:02:02	0:02:09	0:02:34	0:14:31	4		Adm Wm M Callaghan
KNICK 1VE00000086	0:01:37	0:02:03	0:02:10	0:02:35	0:14:35	4		Adm Wm M Callaghan
KNICK 1VE00000087	0:01:37	0:02:04	0:02:11	0:02:36	0:14:39	4		Adm Wm M Callaghan
KNICK 1VE00000088	0:01:37	0:02:05	0:02:12	0:02:37	0:14:43	4		Adm Wm M Callaghan
KNICK 1VE00000089	0:01:37	0:02:06	0:02:13	0:02:38	0:14:47	4		Adm Wm M Callaghan
KNICK 1VE00000090	0:01:37	0:02:07	0:02:14	0:02:39	0:14:51	4		Adm Wm M Callaghan
KNICK 1VE00000091	0:01:37	0:02:08	0:02:15	0:02:40	0:14:55	4	I	Adm Wm M Callaghan
KNICK 1VE00000092	0:01:37	0:02:09	0:02:16	0:02:41	0:14:59	4		Adm Wm M Callaghan
KNICK 1VE00000093	0:01:37	0:02:10	0:02:17	0:02:42	0:15:03	4		Adm Wm M Callaghan
KNICK 1VE00000094	0:01:37	0:02:11	0:02:18	0:02:43	0:15:07	4		Adm Wm M Callaghan
KNICK 1VE00000095	0:01:37	0:02:12	0:02:19	0:02:44	0:15:11	4	h+i+5	Adm Wm M Callaghan
KNICK 1VE00000096	0:01:37	0:02:13	0:02:20	0:02:45	0:15:15	4		Adm Wm M Callaghan
KNICK 1VE00000097	0:01:37	0:02:14	0:02:21	0:02:46	0:15:26	4		Adm Wm M Callaghan
KNICK 1VE00000098	0:01:37	0:02:15	0:02:22	0:02:47	0:15:30	4		Adm Wm M Callaghan
KNICK 1VE00000099	0:01:37	0:02:16	0:02:23	0:02:48	0:15:34	4		Adm Wm M Callaghan
KNICK 1VE00000100	0:01:37	0:02:17	0:02:24	0:02:49	0:15:38	4		Adm Wm M Callaghan

3.2.1.4 Screen Captures of Input Windows for Vehicles via Convoys

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report for the **basecv.rd** scenario. The inputs used are identified by the letters, a...k, which also correspond to labels used in the equations presented in Section 3.2.1.2.



Vehicle Timing Parameters

	ACTUAL TIME	ACTUAL STD. DEVIATION	FIXED COST	VARIABLE COST		
	Minutes	Seconds	Minutes	Seconds	(\$)	(\$/Hour)
d Gate Processing:	1.00	0.00	0.00	0.00	3.00	1.00
e Transit Vehicle Gate To Open Staging:	2.00	0.00	0.00	0.00	0.50	0.25
	2.00	0.00	0.00	0.00	0.50	0.25
	2.00	0.00	0.00	0.00	0.50	0.25
g Open Staging Inspection:	25.00	0.00	0.00	0.00	10.00	3.00
f Open Staging Parking:	5.00	0.00	0.00	0.00	7.00	3.50
h Transit Vehicle To Berth:	2.00	0.00	0.00	0.00	0.50	0.25
i Load Vehicle At RORO Berth:	4.00	0.00	0.00	0.00	8.00	5.00
	4.00	0.00	0.00	0.00	12.00	5.00
	12.00	0.00	0.00	0.00	21.00	8.00
	2.00	0.00	0.00	0.00	8.00	5.00
	5.00	0.00	0.00	0.00	12.00	5.00
	2.00	0.00	0.00	0.00	3.00	1.00
	4.00	0.00	0.00	0.00	0.50	0.25
	4.00	0.00	0.00	0.00	0.50	0.25
	4.00	0.00	0.00	0.00	0.50	0.25
	5.00	0.00	0.00	0.00	0.50	0.25
	3.00	0.00	0.00	0.00	6.00	1.50
	0.00	0.00	0.00	0.00	1.00	1.00
	TO UPDATE VALUES IN THE TABLE ABOVE, SELECT THE APPROPRIATE CELL IN THE TABLE. THEN, ENTER THE NEW VALUE HERE AND HIT RETURN.					
	NEW VALUE: <input type="text" value="0.00"/>					
	<input type="button" value="OK"/>			<input type="button" value="Cancel"/>		

Ship Timing Parameters

	ACTUAL		ACTUAL	
	TIME		STANDARD DEVIATION	
	Minutes	Seconds	Minutes	Seconds
Ship Berthing Time:	180.00	0.00	0.00	0.00
Ship Deberthing Time:	180.00	0.00	0.00	0.00

TO UPDATE VALUES IN THE TABLE ABOVE, SELECT
THE APPROPRIATE CELL IN THE TABLE. THEN,
ENTER THE NEW VALUE HERE AND HIT RETURN.

NEW VALUE:

j

Ship Parameters

Ship Number: 1 Of 2

NISC:	28328	Stow Factor:	0.70
Ship Name:	Adm Wm M Callaghan	Trip Number:	1
Generic Type:	RO/RO: (SqFt) (Fast)		
Fleet Description:	RRF-20		
Speed (knots):	<input type="text" value="25"/>	Length (ft):	<input type="text" value="694"/>
Beam (ft):	<input type="text" value="92"/>	Boom (ft):	<input type="text" value="150"/>
Draft (ft):	<input type="text" value="29"/>		

Maximum Capacities By Cargo Type:

Breakbulk (MTONS): Container (Sq. Ft.):
RORO (Sq. Ft.):

Self Sustaining:

Maximum Time Ship Will Wait Without Loading/Offloading an Item Prior to Departing (hrs.):

k Ship Arrival Time To Port
(Deterministic Arrival Mode Only) in Hours:

Ship Parameters

Ship Number: 2 Of 2

NISC:	29963	Stow Factor:	0.70
Ship Name:	Adabelle Lykes	Trip Number:	1
Generic Type:	Container-BB SS (Slow)		
Fleet Description:	Sea-RdyPgm		
Speed (knots):	20	Length (ft):	660
Beam (ft):	81	Boom (ft):	10
Draft (ft):	26		

Maximum Capacities By Cargo Type:

Breakbulk (MTONS): Container (Sq. Ft.):
RORO (Sq. Ft.):

Self Sustaining:

Maximum Time Ship Will Wait Without Loading/Offloading an Item Prior to Departing (hrs.):

k Ship Arrival Time To Port
(Deterministic Arrival Mode Only) in Hours:

Berth Detailed Parameters

Berth Number: 4 Of 6

Berth Name: Berth 4

Length (ft):	1200	Number of Container Cranes:	1
Depth Alongside At Mean Low Water (ft):	42	Number of Wharf Cranes:	1
Deck Strength (psf):	1000	Maximum Call Forward:	12
Apron Width (ft):	110	Deck Construction:	Concrete
Apron Length Served By Rail (ft):	1200	Fendering:	Wood
Apron Height Above Mean Low Water (ft):	15		
Previous Contiguous Berth:	NA		
Next Contiguous Berth:	Berth 5		

REFERENCE PARAMETERS (NOT USED IN SIMULATION PROCESSING)

Apron Lighting Steam Service Straight Stern RORO Facilities
 Transit Sheds Phone Service
 Water Service Electrical Service

OPERATIONAL PARAMETERS (THESE AFFECT SIMULATION PROCESSING)

Offloaded Vehicles Transferred To Open Staging
 (If Not Checked, Transferred Directly to Outloading Sites)

 Offloaded Containers Transferred To Open Staging
 (If Not Checked, Transferred Directly to Outloading Sites)

 Offloaded Pallets Transferred To Covered Staging
 (If Not Checked, Transferred Directly to Outloading Sites)

 Computer Scanning Required for Vehicles
 Computer Scanning Required for Pallets
 Computer Scanning Required for Containers

Available For Military Use

3.2.1.5 PORTSIM Menu Inputs for Vehicles via Convoys

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report for the **basecv.rd** scenario (and, in general, for convoy vehicles loaded to a RORO ship). The order presented below follows the order of the Cargo Report columns from left to right. The letters a...k are labels for the input variables, which correspond to the letters used in the screen captures in Section 3.2.1.4.

Time Arrived at Port

Parameter > Modify Arrival Mode Time Parameters > Convoy Vehicles
Number of Vehicles per Convoy = a
Time to Begin Simulation Arrival = b
Average Time Between Arrival = c

Time Cleared Gate

Parameter > Modify Process Timing Parameters > Vehicle
Gate Processing = d

Time Parked in Staging

Parameter > Modify Process Timing Parameters > Vehicle
Transit Vehicle Gate to Open Staging = e
Open Staging Parking = f

Time Available to Load

Parameter > Modify Process Timing Parameters > Vehicle
Open Staging Inspection = g

Time Loaded²

Parameter > Modify Process Timing Parameters > Vehicle
Transit Vehicle to Berth = h
Load Vehicle at RORO Berth = i

Parameter > Modify Process Timing Parameters > Ship
Ship Berthing Time = j

Parameter > Modify Ship Parameters
Ship Arrival Time to Port = k

² The TL becomes untraceable when ship berthing time = 0, and ship arrival time to port = 0.

Other Factors Affecting Time Loaded (Depth)

Parameter > Modify Port Parameters > Berth > Detailed Berth Parameters > Maximum Call Forward = 1

Maximum Call Forward indicates the number of drivers available at a particular time to drive convoy vehicles from the staging area to the berth. This number affects the TL by loading the convoy vehicle in groups equal to the Maximum Call Forward. For example, if the Maximum Call Forward = 15, convoy vehicles are loaded in the following groups: 1–15, 16–30, 31–45, ..., and the TL is separated by the LR time.

Between the 15th and 16th convoy vehicle, the 30th and 31st convoy vehicle, the 45th and 46th convoy vehicle, etc., the gap in TL changes to the sum of the Transit Vehicle to Berth time plus Load Vehicle at RORO Berth time plus five minutes. This time is needed to bus the drivers from the berth back to the staging area.

Load Rate

Parameter > Modify Process Timing Parameters > Vehicle
Load Vehicle at RORO Berth = i

3.2.2 Vehicles via Flatcars

3.2.2.1 Diagram of Vehicles via Flatcars

Figure 3 shows the pathway of vehicles via flatcars.

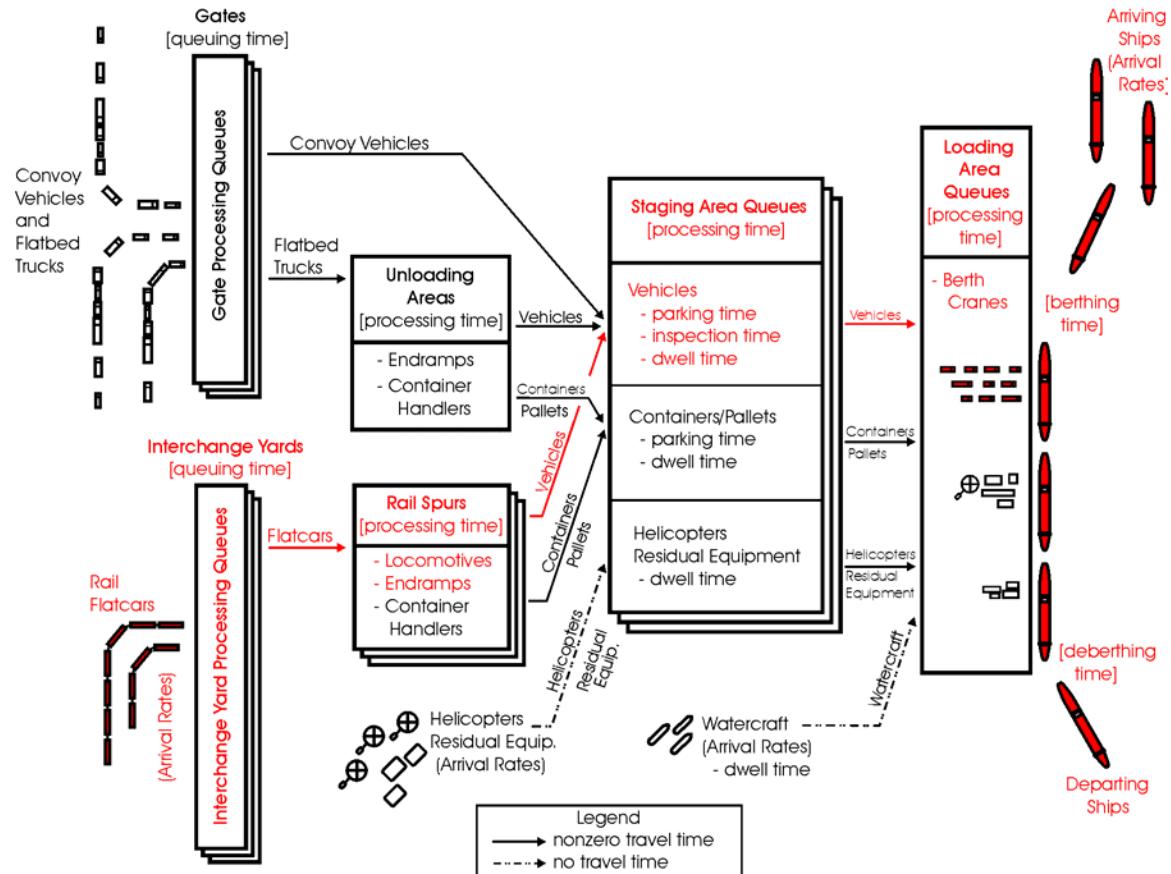


FIGURE 3 Pathway of Vehicles via Flatcars

3.2.2.2 Tracking Sequence for Vehicles via Flatcars

This section presents the equations and logic that reproduce the results of the Cargo Report and the Rail Timing File for the **basecvr.rd** scenario using the **cvrail1.lst** force file. First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report and the Rail Timing File. The order presented starts with the Time Arrived at Port, which is common to both the Cargo Report and the Rail Timing File. The order then follows the ten timing data, left to right, from the Rail Timing File and then picks up with the Cargo Report's Time Parked in Staging, left to right, and ends with the Loading Rate. The entries for the Cargo Reports are shaded in gray.

Here is an example of computing the Remove Tiedown (RT6) for the first and second vehicles from the Rail Timing File. The RT6 of the first vehicle is equal to the time it took to uncouple the locomotive at the spur plus the time to remove the tiedowns. The RT6 of the second vehicle is equal to the previous results plus the time it takes to remove the tiedowns. Section 3.2.2.4 contains a screen capture of all the defined input variables a...u used below.

Notation

N = total number of cargo pieces in the force
 $a\dots u$ = input variables used in PORTSIM
 \wedge = results from previous step (i.e., from the previous cargo item within the same column of the Cargo Report or the Rail Timing File)

Time Arrived at Port = TAP = $f(a, b, c)$

a = Number of Railcars per Train
 b = Time to Begin Simulating Arrivals
 c = Average Time Between Arrivals

Trains are of size “ a ” railcars. The first train arrives at port at time “ b . ” The time separation between trains is equal to a fixed interval of “ c ” hours. All cargo items arriving on the same train are assigned the same Time Arrived at Port.

Arrived at Interchange Yard = RT1 = $f(a, b, c)$

a = Number of Railcars per Train
 b = Time to Begin Simulating Arrivals
 c = Average Time Between Arrivals

Only entire trains can enter the interchange yard. If the interchange yard has insufficient space for the entire train, the train is blocked from entering until adequate space becomes available. If trains cannot enter the interchange yard, the time that the train arrived at the interchange yard will be later than the time it arrived at port. If a train is not blocked, the time it arrived at port will be the same as the time it arrived at the interchange yard.

Once the train arrives at the interchange yard, the concept of a “train” is replaced by a “string of flatcars.” A string of flatcars is a collection of flatcars, possibly from multiple trains as a result of processing at the interchange yard.

With the **basecvr.rd** test scenario and the **cvrail1.lst** force file, the size of a string of flatcars (20 flatcars) is the same as the train size (20 flatcars). In general, this will not happen. Rather, the number of flatcars in a string, which can vary in an execution, is the minimum of the number of flatcars accepted at the spur and the number of flatcars that have completed the interchange process (RT2).

Completed Interchange Yard Process = RT2 = $f(RT1, d)$

d = Processing at Interchange Yard

$$RT2_i = RT1_i + d$$

$$i \in [1, N]$$

Coupled Locomotive at Interchange Yard = RT3 = $f(RT2, RT10, k, e)$

k = Switch Spur to Interchange Yard

e = Couple at Interchange Yard

First string of flatcars:

$$RT3_i = RT2_i + k + e$$

$$i \in [1, 2a]$$

Next string of flatcars:

$$RT3_j = RT10_{2a} + k + e$$

$$j \in [2a + 1, 4a]$$

Next string of flatcars:

$$RT3_k = RT10_{4a} + k + e$$

$$k \in [4a + 1, N]$$

The equations above hold for the **basecvr.rd** scenario. Two exceptions that can occur when using different input variables are described below.

Exception 1: If the locomotive is done (Uncouple Locomotive at Interchange Yard from Spur) with the previous string of flatcars before the next string of flatcars is ready to be coupled to the locomotive (Complete Interchange Yard Process), the locomotive waits until that string of flatcars completes its interchange yard processes. When this occurs, use the equation for the first string of flatcars as noted below:

If $RT10_{2a} < RT2_{2a+1}$, use the first string of flatcars equation.

If $RT10_{4a} < RT2_{4a+1}$, use the first string of flatcars equation.

Exception 2: When the number of flatcars called to the spur exceeds the number of flatcars per train, flatcars from multiple trains are grouped together into a string, provided enough flatcars are ready (RT2). An example of this procedure is seen in **basecvr.rd** when the number of railcars per train is reduced to five. Cargo items 71–80 arrive on one train, cargo items 81–90 on another train, yet all cargo items 71–90 are coupled together at the interchange yard (RT3) at the same time. Also, cargo items 81–90 arrive at port 54 minutes later than cargo items 71–80.

Arrived at Spur = RT4 = $f(RT3, f)$

f = Switch Interchange Yard to Spur

$$RT4_i = RT3_i + f$$

$$i \in [1, N]$$

Uncoupled Locomotive at Spur = RT5 = $f(RT4, g)$

g = Uncouple at Spur

$$RT5_i = RT4_i + g$$

$$i \in [1, N]$$

Removed Tiedown = RT6 = $f(RT5, h)$

h = Remove Flatcar Tiedowns

First string of flatcars:

$$RT6_1 = RT5_1 + h$$

$$RT6_2 = \wedge + h$$

$$\dots$$

$$RT6_{2a} = \wedge + h$$

Next string of flatcars:

$$RT6_{2a+1} = RT5_{2a+1} + h$$

$$RT6_{2a+2} = \wedge + h$$

$$\dots$$

$$RT6_{4a} = \wedge + h$$

Next string of flatcars:

$$RT6_{4a+1} = RT5_{4a+1} + h$$

$$RT6_{4a+2} = \wedge + h$$

$$\dots$$

$$RT6_N = \wedge + h$$

Discharged from Flatcar = RT7 = $f(RT6, i)$

i = Discharge Vehicle Using End Ramp

First string of flatcars:

$$RT7_1 = RT6_{2a} + i$$

$$RT7_2 = \wedge + i$$

$$\dots$$

$$RT7_{2a} = \wedge + i$$

Next string of flatcars:

$$RT7_{2a+1} = RT6_{4a} + i$$

$$RT7_{2a+2} = \wedge + i$$

...

$$RT7_{4a} = \wedge + i$$

Next string of flatcars:

$$RT7_{4a+1} = RT6_N + i$$

$$RT7_{4a+2} = \wedge + i$$

...

$$RT7_N = \wedge + i$$

Tiedowns are removed from the entire string of flatcars before the vehicles are discharged.

Coupled Locomotive At Spur = RT8 = f(RT7, f, j)

f = Switch Interchange Yard to Spur

j = Couple at Spur

First string of flatcars:

$$RT8_i = RT7_{2a} + f + j$$

$$i \in [1, 2a]$$

Next string of flatcars:

$$RT8_j = RT7_{4a} + f + j$$

$$j \in [2a + 1, 4a]$$

Next string of flatcars:

$$RT8_k = RT7_N + f + j$$

$$k \in [4a + 1, N]$$

Arrived at Interchange Yard from Spur = RT9 = f(RT8, k)

k = Switch Spur to Interchange Yard

$$RT9_i = RT8_i + k$$

$$i \in [1, N]$$

Uncoupled Locomotive at Interchange Yard = RT10 = f(RT9, l)

l = Uncouple at Interchange Yard

$$RT10_i = RT9_i + l$$

$$i \in [1, N]$$

Time Parked in Staging = TPS = $f(RT7, m, o)$

m = Transit Vehicle Rail End Ramp to Open Staging
o = Open Staging Parking

$$TPS_i = RT7_i + m + o$$
$$i \in [1, N]$$

Time Available to Load = TAL = $f(TPS, n)$

n = Open Staging Inspection

$$TAL_i = TPS_i + n$$
$$i \in [1, N]$$

The Required Dwell Time in Open Staging (located on page 51 immediately following item "q") was set to zero for **basecvr.rd**. If Required Dwell Time in Open Staging is set to a nonzero value, the value would be added to each TAL.

Time Loaded = TL = $f(t, r, p, s, q, u)$

t = Ship Arrival Time to Port
r = Ship Berthing Time
p = Transit Vehicle to Berth
s = Vehicle Loading Time
q = Stevedore Process on Ship
u = Maximum Call Forward

$$TL_1 = t + r + p + s + q$$

$$TL_2 = ^\wedge + s$$

...

$$TL_N = ^\wedge + s$$

Currently, a stochastic element is used in computing the TL. For simplification, the entire logic of the stochastic element is not presented here; however, TL was verified and found to be correct. The results can be replicated. In versions to follow, a switch will be added so this can be treated deterministically.

The TL is also affected by the Maximum Call Forward. Maximum Call Forward is a berth characteristic that limits the maximum number of cargo items that can be called forward at one time. It affects the TL by loading the convoy vehicles in groups equal to the Maximum Call Forward. For example, if Maximum Call Forward = 15, convoy vehicles are loaded in groups 1–15, 16–30, and 31–45,..., and the TL is separated by the Vehicle Loading Time.

Between the 15th and 16th convoy vehicle, the 30th and 31st convoy vehicle, the 45th and 46th convoy vehicle, etc., the gap in TL changes to the sum of the Transit Vehicle to Berth time plus Vehicle Loading Time plus five minutes. This sum is the time needed to bus the drivers from the berth back to the staging area.

The time needed to bus drivers from berth to staging area every “u” (Maximum Call Forward) convoy vehicles is $p + s + 5$.

The Required Dwell Time in Open Staging (located on page 51 immediately following item “q”) was set to zero for **basecvr.rd**. If Required Dwell Time in Open Staging is set to a nonzero value, the value would be added to the TL.

Loading Rate = LR = f(s)

s = Vehicle Loading Time

$$LR_i = s$$

$$i \in [1, N]$$

3.2.2.3 Cargo Report and Rail Timing File Output for Vehicles via Flatcars

This section contains a printout of the Cargo Report and the Rail Timing File for the **basecvr.rd** scenario using the **cvrail1.lst** force file. The equations from Section 3.2.2.2 are written in some of the cells of the Cargo Report and the Rail Timing File.

PORTSIM Detailed Cargo Report
 (Note: All Times Are Represented In DDD:HH:MM)

Sort Instructions: To sort on a desired column, double-click the column header and the table will be sorted by that column.

LIN ID	TAP	TCG	TPS	TAL	TL	LR	Ship Loaded Onto
	Time Arrived At Port	Time Cleared Gate	Time Parked In Staging	Time Available To Load	Time Loaded	Loading Rate (Minutes)	
KNICK 1VE00000001	0:00:00 TAP ₁	NA	0:06:01 RT7 ₁ +m+o	0:06:26 TPS ₁ +n	0:08:08 t+r+p+s+q	4 s	Adm Wm M Callaghan
KNICK 1VE00000002	0:00:00 TAP ₂	NA	0:06:04 RT7 ₂ +m+o	0:06:29 TPS ₂ +n	0:08:12 ^+s	4 s	Adm Wm M Callaghan
KNICK 1VE00000003	0:00:00 TAP ₃	NA	0:06:07 RT7 ₃ +m+o	0:06:32 TPS ₃ +n	0:08:16 ^+s	4 s	Adm Wm M Callaghan
KNICK 1VE00000004	0:00:00 .	NA	0:06:10 .	0:06:35 .	0:08:20 .	4 .	Adm Wm M Callaghan
KNICK 1VE00000005	0:00:00 .	NA	0:06:13 .	0:06:38 .	0:08:24 .	4 .	Adm Wm M Callaghan
KNICK 1VE00000006	0:00:00 .	NA	0:06:16 .	0:06:41 .	0:08:28 .	4 .	Adm Wm M Callaghan
KNICK 1VE00000007	0:00:00	NA	0:06:19	0:06:44	0:08:32	4	Adm Wm M Callaghan
KNICK 1VE00000008	0:00:00	NA	0:06:22	0:06:47	0:08:36	4	Adm Wm M Callaghan
KNICK 1VE00000009	0:00:00	NA	0:06:25	0:06:50	0:08:40	4	Adm Wm M Callaghan
KNICK 1VE00000010	0:00:00	NA	0:06:28	0:06:53	0:08:44	4	Adm Wm M Callaghan
KNICK 1VE00000011	0:00:00	NA	0:06:31	0:06:56	0:08:48	4	Adm Wm M Callaghan
KNICK 1VE00000012	0:00:00	NA	0:06:34	0:06:59	0:08:52	4	Adm Wm M Callaghan
KNICK 1VE00000013	0:00:00	NA	0:06:37	0:07:02	0:09:03	4	Adm Wm M Callaghan
KNICK 1VE00000014	0:00:00	NA	0:06:40	0:07:05	0:09:07	4	Adm Wm M Callaghan
KNICK 1VE00000015	0:00:00	NA	0:06:43	0:07:08	0:09:11	4	Adm Wm M Callaghan
KNICK 1VE00000016	0:00:00	NA	0:06:46	0:07:11	0:09:15	4	Adm Wm M Callaghan
KNICK 1VE00000017	0:00:00	NA	0:06:49	0:07:14	0:09:19	4	Adm Wm M Callaghan
KNICK 1VE00000018	0:00:00	NA	0:06:52	0:07:17	0:09:23	4	Adm Wm M Callaghan
KNICK 1VE00000019	0:00:00	NA	0:06:55	0:07:20	0:09:27	4	Adm Wm M Callaghan
KNICK 1VE00000020	0:00:00	NA	0:06:58	0:07:23	0:09:31	4	Adm Wm M Callaghan
KNICK 1VE00000021	0:00:00	NA	0:07:01	0:07:26	0:09:35	4	Adm Wm M Callaghan
KNICK 1VE00000022	0:00:00	NA	0:07:04	0:07:29	0:09:39	4	Adm Wm M Callaghan
KNICK 1VE00000023	0:00:00	NA	0:07:07	0:07:32	0:09:43	4	Adm Wm M Callaghan
KNICK 1VE00000024	0:00:00	NA	0:07:10	0:07:35	0:09:47	4	Adm Wm M Callaghan
KNICK 1VE00000025	0:00:00	NA	0:07:13	0:07:38	0:09:58	4	Adm Wm M Callaghan
KNICK 1VE00000026	0:00:00	NA	0:07:16	0:07:41	0:10:02	4	Adm Wm M Callaghan
KNICK 1VE00000027	0:00:00	NA	0:07:19	0:07:44	0:10:06	4	Adm Wm M Callaghan
KNICK 1VE00000028	0:00:00	NA	0:07:22	0:07:47	0:10:10	4	Adm Wm M Callaghan
KNICK 1VE00000029	0:00:00	NA	0:07:25	0:07:50	0:10:14	4	Adm Wm M Callaghan
KNICK 1VE00000030	0:00:00	NA	0:07:28	0:07:53	0:10:18	4	Adm Wm M Callaghan
KNICK 1VE00000031	0:00:00	NA	0:07:31	0:07:56	0:10:22	4	Adm Wm M Callaghan
KNICK 1VE00000032	0:00:00	NA	0:07:34	0:07:59	0:10:26	4	Adm Wm M Callaghan

↑

2a ↑

b

KNICK 1VE00000033	0:00:00	NA	0:07:37	0:08:02	0:10:30	4	Adm Wm M Callaghan
KNICK 1VE00000034	0:00:00	NA	0:07:40	0:08:05	0:10:34	4	Adm Wm M Callaghan
KNICK 1VE00000035	0:00:00	NA	0:07:43	0:08:08	0:10:38	4	Adm Wm M Callaghan
KNICK 1VE00000036	0:00:00	NA	0:07:46	0:08:11	0:10:42	4	Adm Wm M Callaghan
KNICK 1VE00000037	0:00:00	NA	0:07:49	0:08:14	0:10:53	4	Adm Wm M Callaghan
KNICK 1VE00000038	0:00:00	NA	0:07:52	0:08:17	0:10:57	4	Adm Wm M Callaghan
KNICK 1VE00000039	0:00:00	NA	0:07:55	0:08:20	0:11:01	4	Adm Wm M Callaghan
KNICK 1VE00000040	0:00:00	NA	0:07:58	0:08:23	0:11:05	4	Adm Wm M Callaghan
KNICK 1VE00000041	0:00:24	NA	0:12:23	0:12:48	0:12:59	4	Adm Wm M Callaghan
KNICK 1VE00000042	0:00:24	NA	0:12:26	0:12:51	0:13:10	4	Adm Wm M Callaghan
KNICK 1VE00000043	0:00:24	NA	0:12:29	0:12:54	0:13:14	4	Adm Wm M Callaghan
KNICK 1VE00000044	0:00:24	NA	0:12:32	0:12:57	0:13:18	4	Adm Wm M Callaghan
KNICK 1VE00000045	0:00:24	NA	0:12:35	0:13:00	0:13:22	4	Adm Wm M Callaghan
KNICK 1VE00000046	0:00:24	NA	0:12:38	0:13:03	0:13:33	4	Adm Wm M Callaghan
KNICK 1VE00000047	0:00:24	NA	0:12:41	0:13:06	0:13:37	4	Adm Wm M Callaghan
KNICK 1VE00000048	0:00:24	NA	0:12:44	0:13:09	0:13:41	4	Adm Wm M Callaghan
KNICK 1VE00000049	0:00:24	NA	0:12:47	0:13:12	0:13:45	4	Adm Wm M Callaghan
KNICK 1VE00000050	0:00:24	NA	0:12:50	0:13:15	0:13:49	4	Adm Wm M Callaghan
KNICK 1VE00000051	0:00:24	NA	0:12:53	0:13:18	0:13:53	4	Adm Wm M Callaghan
KNICK 1VE00000052	0:00:24	NA	0:12:56	0:13:21	0:13:57	4	Adm Wm M Callaghan
KNICK 1VE00000053	0:00:24	NA	0:12:59	0:13:24	0:14:01	4	Adm Wm M Callaghan
KNICK 1VE00000054	0:00:24	NA	0:13:02	0:13:27	0:14:12	4	Adm Wm M Callaghan
KNICK 1VE00000055	0:00:24	NA	0:13:05	0:13:30	0:14:16	4	Adm Wm M Callaghan
KNICK 1VE00000056	0:00:24	NA	0:13:08	0:13:33	0:14:20	4	Adm Wm M Callaghan
KNICK 1VE00000057	0:00:24	NA	0:13:11	0:13:36	0:14:24	4	Adm Wm M Callaghan
KNICK 1VE00000058	0:00:24	NA	0:13:14	0:13:39	0:14:28	4	Adm Wm M Callaghan
KNICK 1VE00000059	0:00:24	NA	0:13:17	0:13:42	0:14:32	4	Adm Wm M Callaghan
KNICK 1VE00000060	0:00:24	NA	0:13:20	0:13:45	0:14:36	4	Adm Wm M Callaghan
KNICK 1VE00000061	0:00:24	NA	0:13:23	0:13:48	0:14:40	4	Adm Wm M Callaghan
KNICK 1VE00000062	0:00:24	NA	0:13:26	0:13:51	0:14:44	4	Adm Wm M Callaghan
KNICK 1VE00000063	0:00:24	NA	0:13:29	0:13:54	0:14:48	4	Adm Wm M Callaghan
KNICK 1VE00000064	0:00:24	NA	0:13:32	0:13:57	0:14:52	4	Adm Wm M Callaghan
KNICK 1VE00000065	0:00:24	NA	0:13:35	0:14:00	0:14:56	4	Adm Wm M Callaghan
KNICK 1VE00000066	0:00:24	NA	0:13:38	0:14:03	0:15:07	4	Adm Wm M Callaghan
KNICK 1VE00000067	0:00:24	NA	0:13:41	0:14:06	0:15:11	4	Adm Wm M Callaghan
KNICK 1VE00000068	0:00:24	NA	0:13:44	0:14:09	0:15:15	4	Adm Wm M Callaghan
KNICK 1VE00000069	0:00:24	NA	0:13:47	0:14:12	0:15:19	4	Adm Wm M Callaghan
KNICK 1VE00000070	0:00:24	NA	0:13:50	0:14:15	0:15:23	4	Adm Wm M Callaghan
KNICK 1VE00000071	0:00:24	NA	0:13:53	0:14:18	0:15:27	4	Adm Wm M Callaghan
KNICK 1VE00000072	0:00:24	NA	0:13:56	0:14:21	0:15:31	4	Adm Wm M Callaghan
KNICK 1VE00000073	0:00:24	NA	0:13:59	0:14:24	0:15:35	4	Adm Wm M Callaghan
KNICK 1VE00000074	0:00:24	NA	0:14:02	0:14:27	0:15:39	4	Adm Wm M Callaghan

KNICK 1VE00000033
KNICK 1VE00000034
KNICK 1VE00000035
KNICK 1VE00000036
KNICK 1VE00000037
KNICK 1VE00000038
KNICK 1VE00000039
KNICK 1VE00000040

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KNICK 1VE00000075	0:00:24	NA	0:14:05	0:14:30	0:15:43	4	Adm Wm M Callaghan
KNICK 1VE00000076	0:00:24	NA	0:14:08	0:14:33	0:15:47	4	Adm Wm M Callaghan
KNICK 1VE00000077	0:00:24	NA	0:14:11	0:14:36	0:15:51	4	Adm Wm M Callaghan
KNICK 1VE00000078	0:00:24	NA	0:14:14	0:14:39	0:16:02	4	Adm Wm M Callaghan
KNICK 1VE00000079	0:00:24	NA	0:14:17	0:14:42	0:16:06	4	Adm Wm M Callaghan
KNICK 1VE00000080	0:00:24	NA	0:14:20	0:14:45	0:16:10	4	Adm Wm M Callaghan
KNICK 1VE00000081	0:09:01	NA	0:17:05	0:17:30	0:17:46	4	Adm Wm M Callaghan
KNICK 1VE00000082	0:09:01	NA	0:17:08	0:17:33	0:17:50	4	Adm Wm M Callaghan
KNICK 1VE00000083	0:09:01	NA	0:17:11	0:17:36	0:17:54	4	Adm Wm M Callaghan
KNICK 1VE00000084	0:09:01	NA	0:17:14	0:17:39	0:18:05	4	Adm Wm M Callaghan
KNICK 1VE00000085	0:09:01	NA	0:17:17	0:17:42	0:18:09	4	Adm Wm M Callaghan
KNICK 1VE00000086	0:09:01	NA	0:17:20	0:17:45	0:18:13	4	Adm Wm M Callaghan
KNICK 1VE00000087	0:09:01	NA	0:17:23	0:17:48	0:18:17	4	Adm Wm M Callaghan
KNICK 1VE00000088	0:09:01	NA	0:17:26	0:17:51	0:18:21	4	Adm Wm M Callaghan
KNICK 1VE00000089	0:09:01	NA	0:17:29	0:17:54	0:18:25	4	Adm Wm M Callaghan
KNICK 1VE00000090	0:09:01	NA	0:17:32	0:17:57	0:18:29	4	Adm Wm M Callaghan
KNICK 1VE00000091	0:09:01	NA	0:17:35	0:18:00	0:18:40	4	Adm Wm M Callaghan
KNICK 1VE00000092	0:09:01	NA	0:17:38	0:18:03	0:18:44	4	Adm Wm M Callaghan
KNICK 1VE00000093	0:09:01	NA	0:17:41	0:18:06	0:18:48	4	Adm Wm M Callaghan
KNICK 1VE00000094	0:09:01	NA	0:17:44	0:18:09	0:18:52	4	Adm Wm M Callaghan
KNICK 1VE00000095	0:09:01	NA	0:17:47	0:18:12	0:18:56	4	Adm Wm M Callaghan
KNICK 1VE00000096	0:09:01	NA	0:17:50	0:18:15	0:19:00	4	Adm Wm M Callaghan
KNICK 1VE00000097	0:09:01	NA	0:17:53	0:18:18	0:19:04	4	Adm Wm M Callaghan
KNICK 1VE00000098	0:09:01	NA	0:17:56	0:18:21	0:19:08	4	Adm Wm M Callaghan
KNICK 1VE00000099	0:09:01	NA	0:17:59	0:18:24	0:19:12	4	Adm Wm M Callaghan
KNICK 1VE00000100	0:09:01	NA	0:18:02	0:18:27	0:19:16	4	Adm Wm M Callaghan

PORTSIM Rail Timing File

All Times Are Represented in DD:HH:MM

LIN ID ^a	TAP	RT1	RT2	RT3	RT4	RT5	RT6	RT7	RT8	RT9	RT10	
	Arrived At Port	Arrived At IY	Completed IY Process	Coupled Locomotive At IY	Arrived At Spur	Uncoupled Locomotive At Spur	Removed Tiedown	Discharged From Flatcar	Coupled Locomotive At Spur	Arrived At IY	Uncoupled Locomotive At IY	
001	0:00:00	TAP ₁	0:00:00	RT1 ₁	0:02:00	RT1 _{1+d}	0:02:13	RT2 _{1+k+e}	0:02:21	RT3 _{1+f}	0:02:31	RT4 _{1+g}
002	0:00:00	TAP ₂	0:00:00	RT1 ₂	0:02:00	RT1 _{2+d}	0:02:13	RT2 _{2+k+e}	0:02:21	RT3 _{2+f}	0:02:31	RT4 _{2+g}
003	0:00:00	TAP ₃	0:00:00	RT1 ₃	0:02:00	RT1 _{3+d}	0:02:13	RT2 _{3+k+e}	0:02:21	RT3 _{3+f}	0:02:31	RT4 _{3+g}
004	0:00:00	.	0:00:00	.	0:02:00	.	0:02:13	.	0:02:21	.	0:02:31	.
005	0:00:00	.	0:00:00	.	0:02:00	.	0:02:13	.	0:02:21	.	0:02:31	.
006	0:00:00	.	0:00:00	.	0:02:00	.	0:02:13	.	0:02:21	.	0:02:31	.
007	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:06	0:06:12	0:08:04	0:08:12	0:08:22	
008	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:11	0:06:15	0:08:04	0:08:12	0:08:22	
009	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:16	0:06:18	0:08:04	0:08:12	0:08:22	
010	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:21	0:06:21	0:08:04	0:08:12	0:08:22	
011	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:26	0:06:24	0:08:04	0:08:12	0:08:22	
012	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:31	0:06:27	0:08:04	0:08:12	0:08:22	
013	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:36	0:06:30	0:08:04	0:08:12	0:08:22	
014	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:41	0:06:33	0:08:04	0:08:12	0:08:22	
015	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:46	0:06:36	0:08:04	0:08:12	0:08:22	
016	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:51	0:06:39	0:08:04	0:08:12	0:08:22	
017	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:03:56	0:06:42	0:08:04	0:08:12	0:08:22	
018	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:01	0:06:45	0:08:04	0:08:12	0:08:22	
019	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:06	0:06:48	0:08:04	0:08:12	0:08:22	
020	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:11	0:06:51	0:08:04	0:08:12	0:08:22	
021	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:16	0:06:54	0:08:04	0:08:12	0:08:22	
022	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:21	0:06:57	0:08:04	0:08:12	0:08:22	
023	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:26	0:07:00	0:08:04	0:08:12	0:08:22	
024	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:31	0:07:03	0:08:04	0:08:12	0:08:22	
025	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:36	0:07:06	0:08:04	0:08:12	0:08:22	
026	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:41	0:07:09	0:08:04	0:08:12	0:08:22	
027	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:46	0:07:12	0:08:04	0:08:12	0:08:22	
028	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:51	0:07:15	0:08:04	0:08:12	0:08:22	
029	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:04:56	0:07:18	0:08:04	0:08:12	0:08:22	
030	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:01	0:07:21	0:08:04	0:08:12	0:08:22	
031	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:06	0:07:24	0:08:04	0:08:12	0:08:22	
032	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:11	0:07:27	0:08:04	0:08:12	0:08:22	

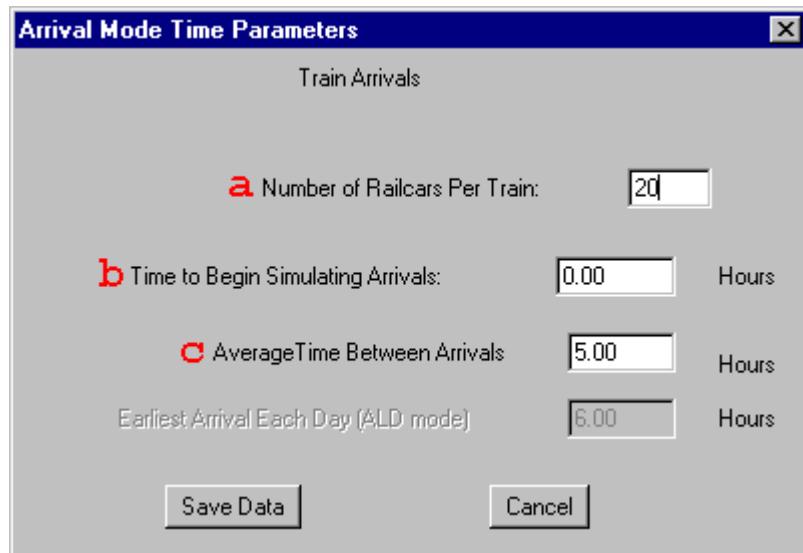
033	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:16	0:07:30	0:08:04	0:08:12	0:08:22
034	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:21	0:07:33	0:08:04	0:08:12	0:08:22
035	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:26	0:07:36	0:08:04	0:08:12	0:08:22
036	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:31	0:07:39	0:08:04	0:08:12	0:08:22
037	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:36	0:07:42	0:08:04	0:08:12	0:08:22
038	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:41	0:07:45	0:08:04	0:08:12	0:08:22
039	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:46	0:07:48	0:08:04	0:08:12	0:08:22
040	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:51	0:07:51	0:08:04	0:08:12	0:08:22 RT10₄₀
041	0:00:24	0:00:24	0:02:24	0:08:35	RT10_{40+e+k}	0:08:43	0:08:53	0:08:58	RT5_{41+h}	0:12:16	RT6_{80+i}
042	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:03	^+h	0:12:19	^+i	0:14:26
043	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:08	^+h	0:12:22	^+i	0:14:26
044	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:13	·	0:12:25	·	0:14:26
045	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:18	·	0:12:28	·	0:14:26
046	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:23	·	0:12:31	·	0:14:26
047	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:28		0:12:34		0:14:26
048	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:33		0:12:37		0:14:26
049	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:38		0:12:40		0:14:26
050	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:43		0:12:43		0:14:26
051	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:48		0:12:46		0:14:26
052	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:53		0:12:49		0:14:26
053	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:09:58		0:12:52		0:14:26
054	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:03		0:12:55		0:14:26
055	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:08		0:12:58		0:14:26
056	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:13		0:13:01		0:14:26
057	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:18		0:13:04		0:14:26
058	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:23		0:13:07		0:14:26
059	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:28		0:13:10		0:14:26
060	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:33		0:13:13		0:14:26
061	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:38		0:13:16		0:14:26
062	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:43		0:13:19		0:14:26
063	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:48		0:13:22		0:14:26
064	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:53		0:13:25		0:14:26
065	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:10:58		0:13:28		0:14:26
066	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:03		0:13:31		0:14:26
067	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:08		0:13:34		0:14:26
068	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:13		0:13:37		0:14:26
069	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:18		0:13:40		0:14:26
070	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:23		0:13:43		0:14:26
071	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:28		0:13:46		0:14:26
072	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:33		0:13:49		0:14:26
											0:14:44

073	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:38	0:13:52	0:14:26	0:14:34	0:14:44
074	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:43	0:13:55	0:14:26	0:14:34	0:14:44
075	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:48	0:13:58	0:14:26	0:14:34	0:14:44
076	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:53	0:14:01	0:14:26	0:14:34	0:14:44
077	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:11:58	0:14:04	0:14:26	0:14:34	0:14:44
078	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:12:03	0:14:07	0:14:26	0:14:34	0:14:44
079	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:12:08	0:14:10	0:14:26	0:14:34	0:14:44
080	0:00:24	0:00:24	0:02:24	0:08:35	0:08:43	0:08:53	0:12:13	0:14:13	0:14:26	0:14:34	0:14:44 RT10₈₀
081	0:09:01	0:09:01	0:11:01	0:14:57 RT10_{80+e+k}	0:15:05	0:15:15	0:15:20 RT5_{81+h}	0:16:58 RT6_{100+i}	0:18:08 RT7_{100+f+j}	0:18:16	0:18:26
082	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:25 ^+h	0:17:01 ^+i	0:18:08 .	0:18:16	0:18:26
083	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:30 ^+h	0:17:04 ^+i	0:18:08 .	0:18:16	0:18:26
084	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:35 .	0:17:07 .	0:18:08 .	0:18:16	0:18:26
085	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:40 .	0:17:10 .	0:18:08	0:18:16	0:18:26
086	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:45 .	0:17:13 .	0:18:08	0:18:16	0:18:26
087	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:50	0:17:16	0:18:08	0:18:16	0:18:26
088	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:15:55	0:17:19	0:18:08	0:18:16	0:18:26
089	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:00	0:17:22	0:18:08	0:18:16	0:18:26
090	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:05	0:17:25	0:18:08	0:18:16	0:18:26
091	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:10	0:17:28	0:18:08	0:18:16	0:18:26
092	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:15	0:17:31	0:18:08	0:18:16	0:18:26
093	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:20	0:17:34	0:18:08	0:18:16	0:18:26
094	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:25	0:17:37	0:18:08	0:18:16	0:18:26
095	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:30	0:17:40	0:18:08	0:18:16	0:18:26
096	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:35	0:17:43	0:18:08	0:18:16	0:18:26
097	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:40	0:17:46	0:18:08	0:18:16	0:18:26
098	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:45	0:17:49	0:18:08	0:18:16	0:18:26
099	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:50	0:17:52	0:18:08	0:18:16	0:18:26
100	0:09:01	0:09:01	0:11:01	0:14:57	0:15:05	0:15:15	0:16:55	0:17:55	0:18:08	0:18:16	0:18:26

a This is an abbreviated LIN ID. The complete LIN ID is preceded by KNICK 1VE00000 for each entry.

3.2.2.4 Screen Captures of Input Windows for Vehicles via Flatcars

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report and Rail Timing File for the **basecvr.rd** scenario. The inputs used are identified by the letters a...u, which also correspond to the labels used in the equations presented in Section 3.2.2.



Railcar Timing Parameters

X

	TIME		+/- RANGE	
	Minutes	Seconds	Minutes	Seconds
d Processing at Interchange Yard:	120.00	0.00	0.00	0.00
e Couple at Interchange Yard:	5.00	0.00	0.00	0.00
f Switch Interchange Yard To Spur:	8.00	0.00	0.00	0.00
Switch Interchange Yard To Berth:	8.00	0.00	0.00	0.00
Switch Interchange Yard To Dock:	8.00	0.00	0.00	0.00
g Uncouple At Spur:	10.00	0.00	0.00	0.00
h Remove Flatcar Tiedowns:	5.00	0.00	0.00	0.00
i Discharge Vehicle Using End Ramp:	3.00	0.00	0.00	0.00
Discharge Vehicle Using Crane:	5.00	0.00	0.00	0.00
Discharge Container At Spur:	0.00	0.00	0.00	0.00
j Couple At Spur:	5.00	0.00	0.00	0.00
k Switch Spur To Interchange Yard:	8.00	0.00	0.00	0.00
Switch Berth To Interchange Yard:	9.00	0.00	0.00	0.00
Switch Dock To Interchange Yard:	8.00	0.00	0.00	0.00
l Uncouple At Interchange Yard:	10.00	0.00	0.00	0.00

To update value in the above table, select
the appropriate cell in the table. Then,
enter the new value here and hit Return.

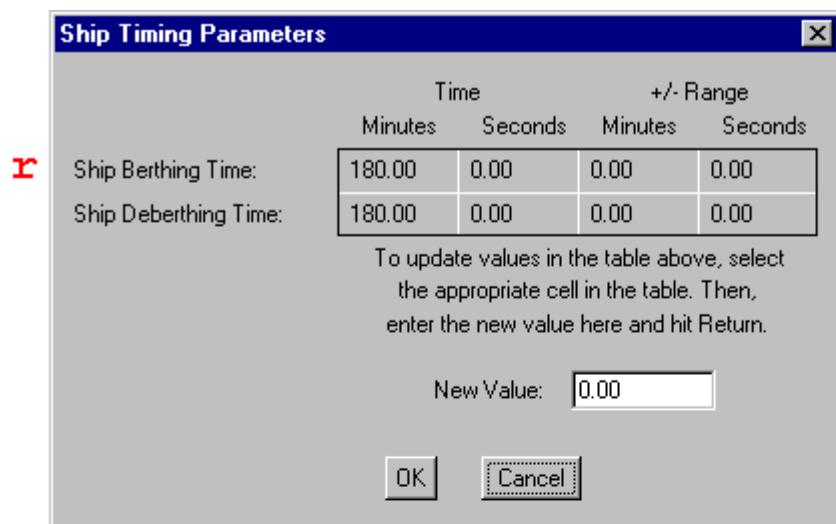
New value:

Vehicle Timing Parameters

	TIME		+/- RANGE	
	Minutes	Seconds	Minutes	Seconds
Gate Processing:	1.00	0.00	0.00	0.00
Transit Vehicle Gate To Open Staging:	2.00	0.00	0.00	0.00
m Transit Vehicle Rail End Ramp To Open Staging:	2.00	0.00	0.00	0.00
Transit Vehicle Truck End Ramp To Open Staging:	12.00	0.00	0.00	0.00
n Open Staging Inspection:	25.00	0.00	0.00	0.00
o Open Staging Parking:	5.00	0.00	0.00	0.00
p Transit Vehicle To Berth:	2.00	0.00	0.00	0.00
q Stevedore Process On Ship:	2.00	0.00	0.00	0.00
* Required Dwell Time In Open Staging:	0.00	0.00	0.00	0.00

To update values in the table above, select the appropriate cell in the table. Then, enter the new value here and hit Return.

New Value:



Ship Parameters

Ship: 1 Of 2

NISC: 28328 Stow Factor:

Ship Name: Adm Wm M Callaghan Trip Number: 1

Generic Type: RO/RO: (SqFt) (Fast)

Fleet Description: RRF-20

Speed (knots): 25.000000 Length (ft):

Beam (ft): 92 Boom (ft): 150

Draft (ft):

Maximum Capacities By Cargo Type:

Breakbulk (MTONS): Container (Sq. Ft.):
RORO (Sq. Ft.):

Self Sustaining:

S Vehicle Loading Time (minutes)

Vehicle Loading Time Standard Dev. (minutes)

Maximum Time Ship Will Wait Without
Loading/Offloading an Item Prior to Departing (hrs.):

t Ship Arrival Time To Port
(Deterministic Arrival Mode Only) in Hours:

Ship Parameters

Ship: 2 Of 2

NISC: 29963 Stow Factor:

Ship Name: Adabelle Lykes Trip Number: 1

Generic Type: Container-BB SS (Slow)

Fleet Description: Sea-RdyPgm

Speed (knots): 19.500000 Length (ft):

Beam (ft): 81 Boom (ft): 10

Draft (ft):

Maximum Capacities By Cargo Type:

Breakbulk (MTONS): Container (Sq. Ft.):
RORO (Sq. Ft.):

Self Sustaining:

S Vehicle Loading Time (minutes)

Vehicle Loading Time Standard Dev. (minutes)

Maximum Time Ship Will Wait Without
Loading/Offloading an Item Prior to Departing (hrs.):

t Ship Arrival Time To Port
(Deterministic Arrival Mode Only) in Hours:

Berth Detailed Parameters

Berth: 4 Of 6

Berth Name: Berth 4

Length (ft):	1200	Number of Container Cranes:	1
Depth Alongside At Mean Low Water (ft):	42	Number of Wharf Cranes:	1
Deck Strength:	1000	U Maximum Call Forward:	12
Apron Width:	110	Deck Construction:	Concrete
Apron Length Served By Rail (ft):	1200	Fendering:	
Apron Height Above Mean Low Water (ft):	15		
Previous Contiguous Berth:	NA		
Next Contiguous Berth:	Berth 5		

Available For Military Use

[Previous Berth](#) [Next Berth](#)

[Save Data](#) [Done](#)

3.2.2.5 PORTSIM Menu Inputs for Vehicles via Flatcars

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report and the Rail Timing File for the **basecvr.rd** scenario (and, in general, for convoy vehicles via flatcars loaded to a RORO ship). The order presented starts with the Time Arrived at Port, which is common to both the Cargo Report and the Rail Timing File. The order then follows the ten timing data, left to right, from the Rail Timing File and picks up with the Cargo Report's Time Parked in Staging, left to right, ending with the Loading Rate. The Cargo Report entries are shaded in gray. The letters a...u are labels for the input variables as shown in the screen captures (Section 3.2.2.4).

Time Arrived at Port

Parameter > Modify Arrival Mode Time Parameters > Trains

Number of Railcars per Train = a

Time to Begin Simulating Arrivals = b

Average Time Between Arrival = c

Arrived at Interchange Yard

Parameter > Modify Arrival Mode Time Parameters > Trains

Number of Railcars per Train = a

Time to Begin Simulating Arrivals = b

Average Time Between Arrival = c

Completed Interchange Yard Process

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters

Processing at Interchange Yard = d

Coupled Locomotive at Interchange Yard

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters

Switch Spur to Interchange Yard = k

Couple at Interchange Yard = e

Arrived at Spur

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters

Switch Interchange Yard to Spur = f

Uncoupled Locomotive at Spur

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters

Uncouple at Spur = g

Removed Tiedown

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters
Remove Flatcar Tiedowns = h

Discharged from Flatcar

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters
Discharge Vehicle Using End Ramp = i

Coupled Locomotive at Spur

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters
Switch Interchange Yard to Spur = f
Couple at Spur = j

Arrived at Interchange Yard from Spur

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters
Switch Spur to Interchange Yard = k

Uncoupled Locomotive at Interchange Yard

Parameters > Modify Process Timing Parameters > Railcar Timing Parameters
Uncouple at Interchange Yard = l

Time Parked in Staging

Parameter > Modify Process Timing Parameters > Vehicle
Transit Vehicle Rail End Ramp to Open Staging = m
Open Staging Parking = o

Time Available to Load

Parameter > Modify Process Timing Parameters > Vehicle
Open Staging Inspection = n

Time Loaded

Parameter > Modify Process Timing Parameters > Vehicle
Transit Vehicle to Berth = p
Stevedore Process on Ship = q

Parameter > Modify Process Timing Parameters > Ship
Ship Berthing Time = r

Parameter > Modify Ship Parameters

Vehicle Loading Time = s

Ship Arrival Time to Port = t

Parameter > Modify Port Parameters > Berth Parameters

Maximum Call Forward = u

Load Rate

Parameter > Modify Ship Parameters

Vehicle Loading Time = s

3.2.3 Containers via Flatbed Trucks

3.2.3.1 Diagram of Containers via Flatbed Trucks

Figure 4 shows the pathway of containers via flatbed trucks.

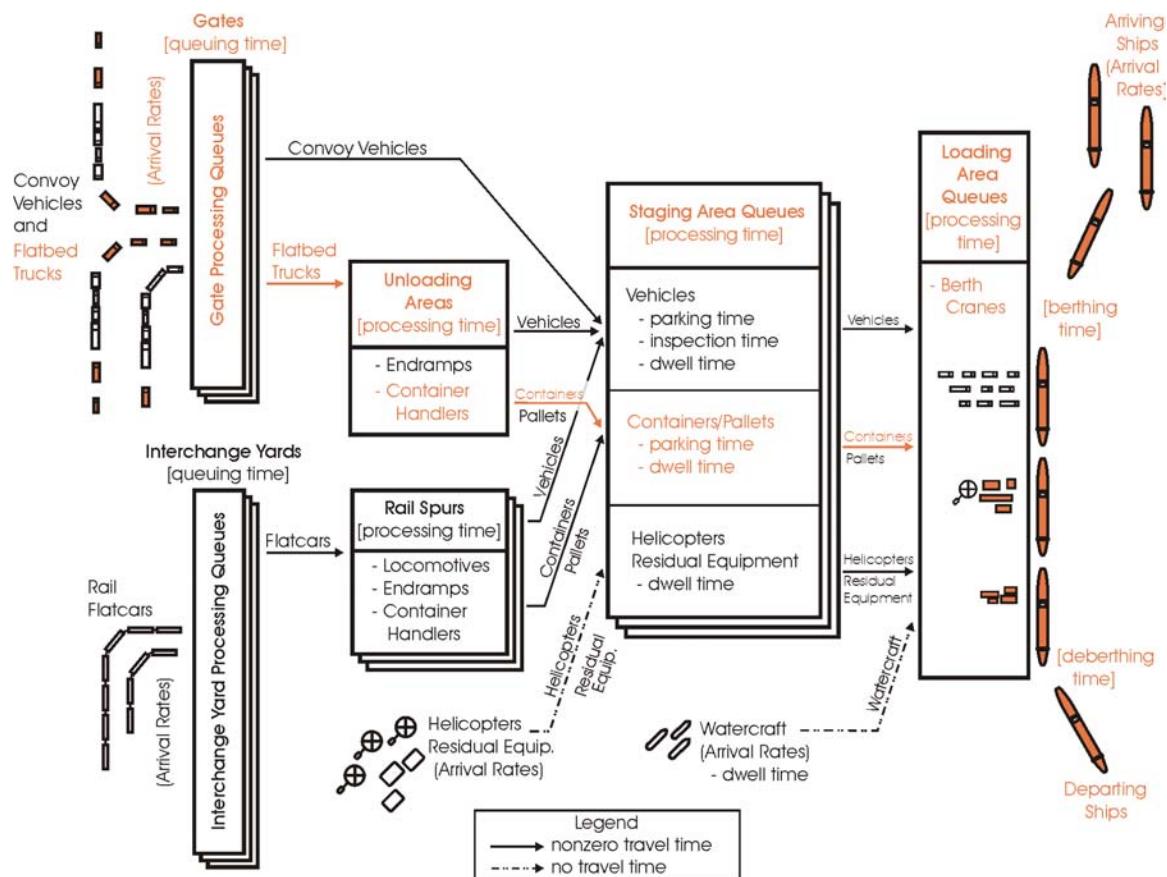


FIGURE 4 Pathway of Containers via Flatbed Trucks

3.2.3.2 Tracking Sequence for Containers via Flatbed Trucks

This section presents the equations and logic that reproduce the results of the Cargo Report for the **basecont_truck.rd** scenario using the **cont_truck.lst** force file (Section 3.2.3.3). First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report. The order presented follows the order of the Cargo Report columns from left to right.

As an example of computing the Time Cleared Gate (TCG) of the first, second, and third containers, the TCG of the first container is equal to the time required for the first container to arrive at port plus the gate processing time. The TCG for the second container is the same as the first container, since they both are on the same flatbed. The time needed for the third container is equal to the TCG for the second container plus the gate processing time. Section 3.2.3.4 contains a screen capture of all the defined input variables a...m used below.

Notation

N = total number of cargo pieces in the force file

$n \in 1, 2, \dots, N$

$a \dots m$ = input variables used in PORTSIM

\wedge = results from previous step, i.e., from the previous cargo item within the same column of the Cargo Report

Time Arrived at Port = TAP = $f(a, b, c)$

a = Number of Flatbeds per Group

b = Time to Begin Simulating Arrivals

c = Time Between Arrivals

The flatbed trucks arrive at port in groups of “ a ” trucks, with the first group arriving at time “ b . $^{\wedge}$ ” The time separation between groups of flatbed trucks is equal to a fixed interval of “ c ” minutes. All cargo items arriving in the same group are assigned the same Time Arrived at Port.

Time Cleared Gate = TCG = $f(TAP, d)$

d = Gate Processing

Each flatbed truck used in the force file, **cont_truck.lst**, holds two containers. For this reason, each pair of containers per flatbed truck will have the same Time Cleared Gate time.

$$TCG_1 = TAP_1 + d$$

$$TCG_2 = TCG_1$$

$$TCG_3 = \wedge + d$$

$$TCG_4 = TCG_3$$

...

$$\begin{aligned} \text{TCG}_{N-1} &= \wedge + d \\ \text{TCG}_N &= \text{TCG}_{N-1} \end{aligned}$$

The equations above hold for the **basecont_truck.rd** scenario. An exception to this formulation occurs when $\text{TAP}_{n+1} > \text{TCG}_n$. That is, the previous group of flatbeds has completely cleared the gate before the next group of flatbeds has arrived to port, resulting in a forced wait time between the groups. When this event occurs, use the formulations below:

$$\begin{aligned} \text{TCG}_{n+1} &= \text{TAP}_{n+1} + d \\ \text{TCG}_{n+2} &= \text{TCG}_{n+1} \\ \text{TCG}_{n+3} &= \wedge + d \\ \text{TCG}_{n+4} &= \text{TCG}_{n+3} \\ \dots \end{aligned}$$

Time Parked in Staging = TPS = f(TCG, e, f, g)

- e = Transit to Container Handler
- f = Offload Container at Container Handler
- g = Open Staging Parking

The two containers per flatbed truck share the Transit to Container Handler time since they are both on the same truck; however, the containers are offloaded one at a time. While the first container is offloaded, the second container waits, hence, the $2f$ found in the TPS_2 , $\text{TPS}_4 \dots \text{TPS}_N$ formulations.

$$\begin{aligned} \text{TPS}_1 &= \text{TCG}_1 + e + f + g \\ \text{TPS}_2 &= \text{TCG}_1 + e + 2f + g \\ \text{TPS}_3 &= \text{TCG}_3 + e + f + g \\ \text{TPS}_4 &= \text{TCG}_3 + e + 2f + g \\ \dots \\ \text{TPS}_{N-1} &= \text{TCG}_{N-1} + e + f + g \\ \text{TPS}_N &= \text{TCG}_{N-1} + e + 2f + g \end{aligned}$$

Time Available to Load = TAL = f(TPS, h)

- h = Required Dwell Time in Open Staging

$$\begin{aligned} \text{TAL}_1 &= \text{TPS}_1 + h \\ \text{TAL}_2 &= \text{TPS}_2 + h \\ \dots \\ \text{TAL}_N &= \text{TPS}_N + h \end{aligned}$$

Time Loaded = TL = f(i, j, k, l, m)

- i = Ship Arrival Time to Port
- j = Ship Berthing Time
- k = Transit Container to Berth

$$1 = \text{Load Container at Container Berth}$$

$$m = \text{Maximum Call Forward}$$

$$\text{Call Forward Group Lag Time} = [0.25(m - 1)]$$

The CEIL function indicates rounding up of the argument.

The following equations are listed in order of TL rather than by LIN ID.

$$TL_1 = i + j + k + 1 + \text{CEIL}[0.25(m - 1)]$$

$$TL_3 = ^+1$$

$$TL_2 = ^+1$$

$$TL_5 = ^+1$$

$$TL_4 = ^+1$$

$$TL_7 = ^+1$$

$$TL_6 = ^+1$$

$$\dots$$

$$TL_N = ^+1$$

The arrows in Figure 5 indicate the ordering as sorted by TL (rather than by LIN ID).

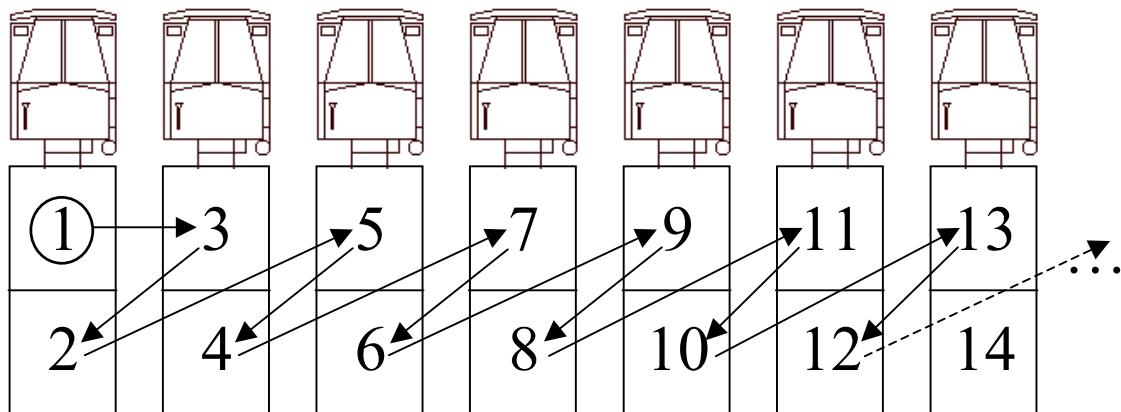


FIGURE 5 Time Loaded (TL) Order

The Call Forward Group Lag Time is hard wired but also determined in part by the Maximum Call Forward value. For the **basecont_truck.rd** scenario, the Maximum Call Forward is 12. Twelve cargo items are instantaneously called forward. The lag time between each item is 0.25 minutes. The first item starts traveling (from the staging area to the berth) at time zero, and the next 11 items that complete the call forward produce a total lag time of 2.75 minutes, the Call Forward Group Lag Time. Loading of the first item in the call forward group does not begin until the last item in the call forward group reaches the berth. The Cargo Report gives time only to the minute and always rounds up (CEIL function), for example, converting the 2.75 minutes to 3 minutes for computing TL_1 .

The Call Forward Group Lag Time also affects the gap in time between each call forward group, which is every 12 items for the **basecont_truck.rd** scenario. The formulation

of the gap between the call forward groups is equal to the Transit Container to Berth plus the Load Container at Container Berth plus the ceiling on the Call Forward Group Lag Time, $k + 1 + \text{CEIL}[0.25(m - 1)]$. Because of rounding up, the gaps between call forward groups may be 7 or 8 minutes. The last gap is smaller because the call forward contains less than 12 cargo items.

Loading Rate = LR = $f(l)$

l = Load Container at Container Berth

$$LR_1 = l$$

$$LR_2 = l$$

...

$$LR_N = l$$

3.2.3.3 Cargo Report Output for Containers via Flatbed Trucks

This section contains a printout of the Cargo Report for the **basecont_truck.rd** scenario using the **cont_truck.lst** force file. Two copies of the Cargo Report are included: one sorted by the LIN ID and one by the TL. The equations from Section 3.2.3.2 are written in some of the cells of the two Cargo Reports.

PORTSIM Detailed Cargo Report
 (Note: All Times Are Represented In DDD:HH:MM)

Sorted by LIN ID

Sort Instructions: To sort on a desired column, double-click the column header and the table will be sorted by that column.

LIN ID	TAP	TCG	TPS	TAL	TL	LR	Ship Loaded Onto
	Time Arrived At Port	Time Cleared Gate	Time Parked In Staging	Time Available To Load	Time Loaded	Loading Rate (Minutes)	
KMOTXT1C 00000001	0:00:00 TAP₁	0:00:03 TAP_{1+d}	0:00:15 TCG_{1+e+f+g}	0:02:15 TPS_{1+h}	0:08:08	3	Chesapeake Bay
KMOTXT1C 00000002	0:00:00 TAP₂	0:00:03 TCG₁	0:00:20 TCG_{1+e+2f+g}	0:02:20 TPS_{2+h}	0:08:14	3	Chesapeake Bay
KMOTXT1C 00000003	0:00:00 TAP₃	0:00:06 ^ + d	0:00:18 TCG_{3+e+f+g}	0:02:18 TPS_{3+h}	0:08:11	3	Chesapeake Bay
KMOTXT1C 00000004	0:00:00 .	0:00:06 .	0:00:23 TCG_{3+e+2f+g}	0:02:23 .	0:08:20	3 .	Chesapeake Bay
KMOTXT1C 00000005	0:00:00 .	0:00:09 .	0:00:21 .	0:02:21 .	0:08:17	3 .	Chesapeake Bay
KMOTXT1C 00000006	0:00:00 .	0:00:09 .	0:00:26 .	0:02:26 .	0:08:26	3 .	Chesapeake Bay
KMOTXT1C 00000007	0:00:00	0:00:12	0:00:24 .	0:02:24 .	0:08:23	3	Chesapeake Bay
KMOTXT1C 00000008	0:00:00	0:00:12	0:00:29	0:02:29	0:08:32	3	Chesapeake Bay
KMOTXT1C 00000009	0:00:00	0:00:15	0:00:27	0:02:27	0:08:29	3	Chesapeake Bay
KMOTXT1C 00000010	0:00:00	0:00:15	0:00:32	0:02:32	0:08:38	3	Chesapeake Bay
KMOTXT1C 00000011	0:00:00	0:00:18	0:00:30	0:02:30	0:08:35	3	Chesapeake Bay
KMOTXT1C 00000012	0:00:00	0:00:18	0:00:35	0:02:35	0:08:49	3	Chesapeake Bay
KMOTXT1C 00000013	0:00:00	0:00:21	0:00:33	0:02:33	0:08:41	3	Chesapeake Bay
KMOTXT1C 00000014	0:00:00	0:00:21	0:00:38	0:02:38	0:08:55	3	Chesapeake Bay
KMOTXT1C 00000015	0:00:00	0:00:24	0:00:36	0:02:36	0:08:52	3	Chesapeake Bay
KMOTXT1C 00000016	0:00:00	0:00:24 b	0:00:41	0:02:41	0:09:01	3	Chesapeake Bay
KMOTXT1C 00000017	0:00:00	0:00:27	0:00:39	0:02:39	0:08:58	3	Chesapeake Bay
KMOTXT1C 00000018	0:00:00	0:00:27	0:00:44	0:02:44	0:09:07	3	Chesapeake Bay
KMOTXT1C 00000019	0:00:00	0:00:30	0:00:42	0:02:42	0:09:04	3	Chesapeake Bay
KMOTXT1C 00000020	0:00:00	0:00:30	0:00:47	0:02:47	0:09:13	3	Chesapeake Bay
KMOTXT1C 00000021	0:00:00	0:00:33	0:00:45	0:02:45	0:09:10	3	Chesapeake Bay
KMOTXT1C 00000022	0:00:00	0:00:33	0:00:50	0:02:50	0:09:19	3	Chesapeake Bay
KMOTXT1C 00000023	0:00:00	0:00:36	0:00:48	0:02:48	0:09:16	3	Chesapeake Bay
KMOTXT1C 00000024	0:00:00	0:00:36	0:00:53	0:02:53	0:09:29	3	Chesapeake Bay
KMOTXT1C 00000025	0:00:00	0:00:39	0:00:51	0:02:51	0:09:22	3	Chesapeake Bay
KMOTXT1C 00000026	0:00:00	0:00:39	0:00:56	0:02:56	0:09:35	3	Chesapeake Bay
KMOTXT1C 00000027	0:00:00	0:00:42	0:00:54	0:02:54	0:09:32	3	Chesapeake Bay
KMOTXT1C 00000028	0:00:00	0:00:42	0:00:59	0:02:59	0:09:41	3	Chesapeake Bay
KMOTXT1C 00000029	0:00:00	0:00:45	0:00:57	0:02:57	0:09:38	3	Chesapeake Bay
KMOTXT1C 00000030	0:00:00	0:00:45	0:01:02	0:03:02	0:09:47	3	Chesapeake Bay
KMOTXT1C 00000031	0:00:00	0:00:48	0:01:00	0:03:00	0:09:44	3	Chesapeake Bay
KMOTXT1C 00000032	0:00:00	0:00:48	0:01:05	0:03:05	0:09:53	3	Chesapeake Bay

♂

2a

6	KMOTXT1C 00000033	0:00:00	0:00:51	0:01:03	0:03:03	0:09:50	3	Chesapeake Bay
	KMOTXT1C 00000034	0:00:00	0:00:51	0:01:08	0:03:08	0:09:59	3	Chesapeake Bay
	KMOTXT1C 00000035	0:00:00	0:00:54	0:01:06	0:03:06	0:09:56	3	Chesapeake Bay
	KMOTXT1C 00000036	0:00:00	0:00:54	0:01:11	0:03:11	0:10:10	3	Chesapeake Bay
	KMOTXT1C 00000037	0:00:00	0:00:57	0:01:09	0:03:09	0:10:02	3	Chesapeake Bay
	KMOTXT1C 00000038	0:00:00	0:00:57	0:01:14	0:03:14	0:10:16	3	Chesapeake Bay
	KMOTXT1C 00000039	0:00:00	0:01:00	0:01:12	0:03:12	0:10:13	3	Chesapeake Bay
	KMOTXT1C 00000040	0:00:00	0:01:00	0:01:17	0:03:17	0:10:22	3	Chesapeake Bay
	KMOTXT1C 00000041	0:00:40	0:01:03	0:01:15	0:03:15	0:10:19	3	Chesapeake Bay
	KMOTXT1C 00000042	0:00:40	0:01:03	0:01:20	0:03:20	0:10:28	3	Chesapeake Bay
	KMOTXT1C 00000043	0:00:40	0:01:06	0:01:18	0:03:18	0:10:25	3	Chesapeake Bay
	KMOTXT1C 00000044	0:00:40	0:01:06	0:01:23	0:03:23	0:10:34	3	Chesapeake Bay
	KMOTXT1C 00000045	0:00:40	0:01:09	0:01:21	0:03:21	0:10:31	3	Chesapeake Bay
	KMOTXT1C 00000046	0:00:40	0:01:09	0:01:26	0:03:26	0:10:40	3	Chesapeake Bay
	KMOTXT1C 00000047	0:00:40	0:01:12	0:01:24	0:03:24	0:10:37	3	Chesapeake Bay
	KMOTXT1C 00000048	0:00:40	0:01:12	0:01:29	0:03:29	0:10:51	3	Chesapeake Bay
	KMOTXT1C 00000049	0:00:40	0:01:15	0:01:27	0:03:27	0:10:43	3	Chesapeake Bay
	KMOTXT1C 00000050	0:00:40	0:01:15	0:01:32	0:03:32	0:10:57	3	Chesapeake Bay
	KMOTXT1C 00000051	0:00:40	0:01:18	0:01:30	0:03:30	0:10:54	3	Chesapeake Bay
	KMOTXT1C 00000052	0:00:40	0:01:18	0:01:35	0:03:35	0:11:03	3	Chesapeake Bay
	KMOTXT1C 00000053	0:00:40	0:01:21	0:01:33	0:03:33	0:11:00	3	Chesapeake Bay
	KMOTXT1C 00000054	0:00:40	0:01:21	0:01:38	0:03:38	0:11:09	3	Chesapeake Bay
	KMOTXT1C 00000055	0:00:40	0:01:24	0:01:36	0:03:36	0:11:06	3	Chesapeake Bay
	KMOTXT1C 00000056	0:00:40	0:01:24	0:01:41	0:03:41	0:11:15	3	Chesapeake Bay
	KMOTXT1C 00000057	0:00:40	0:01:27	0:01:39	0:03:39	0:11:12	3	Chesapeake Bay
	KMOTXT1C 00000058	0:00:40	0:01:27	0:01:44	0:03:44	0:11:21	3	Chesapeake Bay
	KMOTXT1C 00000059	0:00:40	0:01:30	0:01:42	0:03:42	0:11:18	3	Chesapeake Bay
	KMOTXT1C 00000060	0:00:40	0:01:30	0:01:47	0:03:47	0:11:32	3	Chesapeake Bay
	KMOTXT1C 00000061	0:00:40	0:01:33	0:01:45	0:03:45	0:11:24	3	Chesapeake Bay
	KMOTXT1C 00000062	0:00:40	0:01:33	0:01:50	0:03:50	0:11:38	3	Chesapeake Bay
	KMOTXT1C 00000063	0:00:40	0:01:36	0:01:48	0:03:48	0:11:35	3	Chesapeake Bay
	KMOTXT1C 00000064	0:00:40	0:01:36	0:01:53	0:03:53	0:11:44	3	Chesapeake Bay
	KMOTXT1C 00000065	0:00:40	0:01:39	0:01:51	0:03:51	0:11:41	3	Chesapeake Bay
	KMOTXT1C 00000066	0:00:40	0:01:39	0:01:56	0:03:56	0:11:50	3	Chesapeake Bay
	KMOTXT1C 00000067	0:00:40	0:01:42	0:01:54	0:03:54	0:11:47	3	Chesapeake Bay
	KMOTXT1C 00000068	0:00:40	0:01:42	0:01:59	0:03:59	0:11:56	3	Chesapeake Bay
	KMOTXT1C 00000069	0:00:40	0:01:45	0:01:57	0:03:57	0:11:53	3	Chesapeake Bay
	KMOTXT1C 00000070	0:00:40	0:01:45	0:02:02	0:04:02	0:12:02	3	Chesapeake Bay
	KMOTXT1C 00000071	0:00:40	0:01:48	0:02:00	0:04:00	0:11:59	3	Chesapeake Bay
	KMOTXT1C 00000072	0:00:40	0:01:48	0:02:05	0:04:05	0:12:12	3	Chesapeake Bay
	KMOTXT1C 00000073	0:00:40	0:01:51	0:02:03	0:04:03	0:12:05	3	Chesapeake Bay
	KMOTXT1C 00000074	0:00:40	0:01:51	0:02:08	0:04:08	0:12:18	3	Chesapeake Bay

KMOTXT1C 00000075	0:00:40	0:01:54	0:02:06	0:04:06	0:12:15	3	Chesapeake Bay
KMOTXT1C 00000076	0:00:40	0:01:54	0:02:11	0:04:11	0:12:24	3	Chesapeake Bay
KMOTXT1C 00000077	0:00:40	0:01:57	0:02:09	0:04:09	0:12:21	3	Chesapeake Bay
KMOTXT1C 00000078	0:00:40	0:01:57	0:02:14	0:04:14	0:12:30	3	Chesapeake Bay
KMOTXT1C 00000079	0:00:40	0:02:00	0:02:12	0:04:12	0:12:27	3	Chesapeake Bay
KMOTXT1C 00000080	0:00:40	0:02:00	0:02:17	0:04:17	0:12:36	3	Chesapeake Bay
KMOTXT1C 00000081	0:01:20	0:02:03	0:02:15	0:04:15	0:12:33	3	Chesapeake Bay
KMOTXT1C 00000082	0:01:20	0:02:03	0:02:20	0:04:20	0:12:42	3	Chesapeake Bay
KMOTXT1C 00000083	0:01:20	0:02:06	0:02:18	0:04:18	0:12:39	3	Chesapeake Bay
KMOTXT1C 00000084	0:01:20	0:02:06	0:02:23	0:04:23	0:12:53	3	Chesapeake Bay
KMOTXT1C 00000085	0:01:20	0:02:09	0:02:21	0:04:21	0:12:45	3	Chesapeake Bay
KMOTXT1C 00000086	0:01:20	0:02:09	0:02:26	0:04:26	0:12:59	3	Chesapeake Bay
KMOTXT1C 00000087	0:01:20	0:02:12	0:02:24	0:04:24	0:12:56	3	Chesapeake Bay
KMOTXT1C 00000088	0:01:20	0:02:12	0:02:29	0:04:29	0:13:05	3	Chesapeake Bay
KMOTXT1C 00000089	0:01:20	0:02:15	0:02:27	0:04:27	0:13:02	3	Chesapeake Bay
KMOTXT1C 00000090	0:01:20	0:02:15	0:02:32	0:04:32	0:13:11	3	Chesapeake Bay
KMOTXT1C 00000091	0:01:20	0:02:18	0:02:30	0:04:30	0:13:08	3	Chesapeake Bay
KMOTXT1C 00000092	0:01:20	0:02:18	0:02:35	0:04:35	0:13:17	3	Chesapeake Bay
KMOTXT1C 00000093	0:01:20	0:02:21	0:02:33	0:04:33	0:13:14	3	Chesapeake Bay
KMOTXT1C 00000094	0:01:20	0:02:21	0:02:38	0:04:38	0:13:23	3	Chesapeake Bay
KMOTXT1C 00000095	0:01:20	0:02:24	0:02:36	0:04:36	0:13:20	3	Chesapeake Bay
KMOTXT1C 00000096	0:01:20	0:02:24	0:02:41	0:04:41	0:13:32	3	Chesapeake Bay
KMOTXT1C 00000097	0:01:20	0:02:27	0:02:39	0:04:39	0:13:26	3	Chesapeake Bay
KMOTXT1C 00000098	0:01:20	0:02:27	0:02:44	0:04:44	0:13:38	3	Chesapeake Bay
KMOTXT1C 00000099	0:01:20	0:02:30	0:02:42	0:04:42	0:13:35	3	Chesapeake Bay
KMOTXT1C 00000100	0:01:20	0:02:30	0:02:47	0:04:47	0:13:41	3	Chesapeake Bay

PORTSIM Detailed Cargo Report
 (Note: All Times Are Represented In DDD:HH:MM)

Sorted by Time Loaded

Sort Instructions: To sort on a desired column, double-click the column header and the table will be sorted by that column.

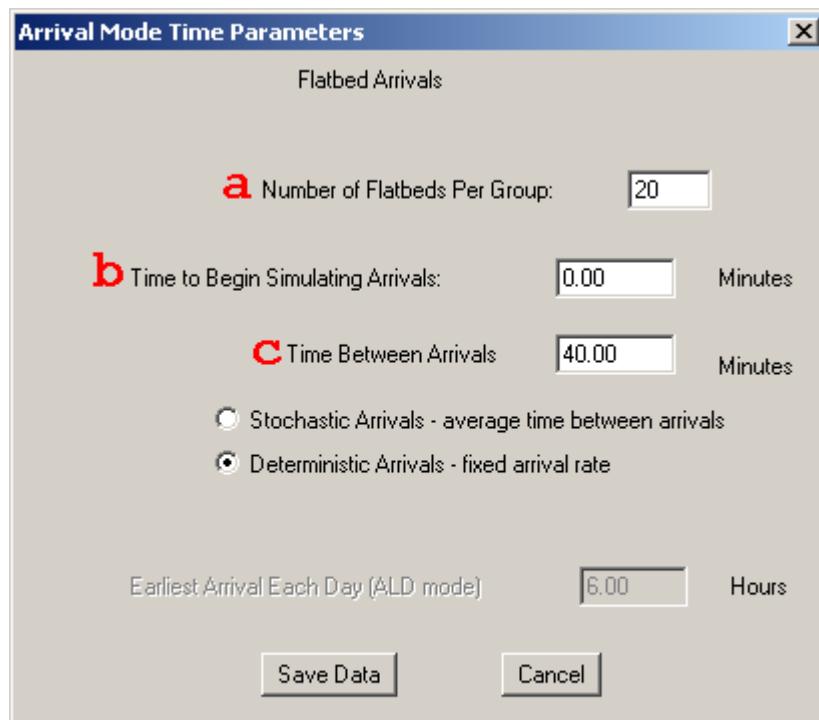
LIN ID	TAP		TCG		TPS		TAL		TL		LR		Ship Loaded Onto
	Time	Arrived At	Time	Cleared	Time	Parked In	Time	Available	Time	Loaded	Loading	Rate	
	Port	Gate	Staging		To Load						(Minutes)		
KMOTXT1C 00000001	0:00:00	0:00:03	0:00:15		0:02:15		0:08:08		i+j+k+l+CEIL[.25(m-1)]		3		Chesapeake Bay
KMOTXT1C 00000003	0:00:00	0:00:06	0:00:18		0:02:18		0:08:11		^ + l		3		Chesapeake Bay
KMOTXT1C 00000002	0:00:00	0:00:03	0:00:20		0:02:20		0:08:14		^ + l		3		Chesapeake Bay
KMOTXT1C 00000005	0:00:00	0:00:09	0:00:21		0:02:21		0:08:17		.		3		Chesapeake Bay
KMOTXT1C 00000004	0:00:00	0:00:06	0:00:23		0:02:23		0:08:20		.		3		Chesapeake Bay
KMOTXT1C 00000007	0:00:00	0:00:12	0:00:24		0:02:24		0:08:23		.		3		Chesapeake Bay
KMOTXT1C 00000006	0:00:00	0:00:09	0:00:26		0:02:26		0:08:26				3		Chesapeake Bay
KMOTXT1C 00000009	0:00:00	0:00:15	0:00:27		0:02:27		0:08:29				3		Chesapeake Bay
KMOTXT1C 00000008	0:00:00	0:00:12	0:00:29		0:02:29		0:08:32				3		Chesapeake Bay
KMOTXT1C 00000011	0:00:00	0:00:18	0:00:30		0:02:30		0:08:35				3		Chesapeake Bay
KMOTXT1C 00000010	0:00:00	0:00:15	0:00:32		0:02:32		0:08:38				3		Chesapeake Bay
KMOTXT1C 00000013	0:00:00	0:00:21	0:00:33		0:02:33		0:08:41				3		Chesapeake Bay
KMOTXT1C 00000012	0:00:00	0:00:18	0:00:35		0:02:35		0:08:49				3		Chesapeake Bay
KMOTXT1C 00000015	0:00:00	0:00:24	0:00:36		0:02:36		0:08:52				3		Chesapeake Bay
KMOTXT1C 00000014	0:00:00	0:00:21	0:00:38		0:02:38		0:08:55				3		Chesapeake Bay
KMOTXT1C 00000017	0:00:00	0:00:27	0:00:39		0:02:39		0:08:58				3		Chesapeake Bay
KMOTXT1C 00000016	0:00:00	0:00:24	0:00:41		0:02:41		0:09:01				3		Chesapeake Bay
KMOTXT1C 00000019	0:00:00	0:00:30	0:00:42		0:02:42		0:09:04				3		Chesapeake Bay
KMOTXT1C 00000018	0:00:00	0:00:27	0:00:44		0:02:44		0:09:07				3		Chesapeake Bay
KMOTXT1C 00000021	0:00:00	0:00:33	0:00:45		0:02:45		0:09:10				3		Chesapeake Bay
KMOTXT1C 00000020	0:00:00	0:00:30	0:00:47		0:02:47		0:09:13				3		Chesapeake Bay
KMOTXT1C 00000023	0:00:00	0:00:36	0:00:48		0:02:48		0:09:16				3		Chesapeake Bay
KMOTXT1C 00000022	0:00:00	0:00:33	0:00:50		0:02:50		0:09:19				3		Chesapeake Bay
KMOTXT1C 00000025	0:00:00	0:00:39	0:00:51		0:02:51		0:09:22				3		Chesapeake Bay
KMOTXT1C 00000024	0:00:00	0:00:36	0:00:53		0:02:53		0:09:29				3		Chesapeake Bay
KMOTXT1C 00000027	0:00:00	0:00:42	0:00:54		0:02:54		0:09:32				3		Chesapeake Bay
KMOTXT1C 00000026	0:00:00	0:00:39	0:00:56		0:02:56		0:09:35				3		Chesapeake Bay
KMOTXT1C 00000029	0:00:00	0:00:45	0:00:57		0:02:57		0:09:38				3		Chesapeake Bay
KMOTXT1C 00000028	0:00:00	0:00:42	0:00:59		0:02:59		0:09:41				3		Chesapeake Bay
KMOTXT1C 00000031	0:00:00	0:00:48	0:01:00		0:03:00		0:09:44				3		Chesapeake Bay
KMOTXT1C 00000030	0:00:00	0:00:45	0:01:02		0:03:02		0:09:47				3		Chesapeake Bay
KMOTXT1C 00000033	0:00:00	0:00:51	0:01:03		0:03:03		0:09:50				3		Chesapeake Bay

	KMOTXT1C 00000032	0:00:00	0:00:48	0:01:05	0:03:05	0:09:53	3	Chesapeake Bay
	KMOTXT1C 00000035	0:00:00	0:00:54	0:01:06	0:03:06	0:09:56	3	Chesapeake Bay
	KMOTXT1C 00000034	0:00:00	0:00:51	0:01:08	0:03:08	0:09:59	3	Chesapeake Bay
	KMOTXT1C 00000037	0:00:00	0:00:57	0:01:09	0:03:09	0:10:02	3	Chesapeake Bay
	KMOTXT1C 00000036	0:00:00	0:00:54	0:01:11	0:03:11	0:10:10	3	Chesapeake Bay
	KMOTXT1C 00000039	0:00:00	0:01:00	0:01:12	0:03:12	0:10:13	3	Chesapeake Bay
	KMOTXT1C 00000038	0:00:00	0:00:57	0:01:14	0:03:14	0:10:16	3	Chesapeake Bay
	KMOTXT1C 00000041	0:00:40	0:01:03	0:01:15	0:03:15	0:10:19	3	Chesapeake Bay
	KMOTXT1C 00000040	0:00:00	0:01:00	0:01:17	0:03:17	0:10:22	3	Chesapeake Bay
	KMOTXT1C 00000043	0:00:40	0:01:06	0:01:18	0:03:18	0:10:25	3	Chesapeake Bay
	KMOTXT1C 00000042	0:00:40	0:01:03	0:01:20	0:03:20	0:10:28	3	Chesapeake Bay
	KMOTXT1C 00000045	0:00:40	0:01:09	0:01:21	0:03:21	0:10:31	3	Chesapeake Bay
	KMOTXT1C 00000044	0:00:40	0:01:06	0:01:23	0:03:23	0:10:34	3	Chesapeake Bay
	KMOTXT1C 00000047	0:00:40	0:01:12	0:01:24	0:03:24	0:10:37	3	Chesapeake Bay
	KMOTXT1C 00000046	0:00:40	0:01:09	0:01:26	0:03:26	0:10:40	3	Chesapeake Bay
	KMOTXT1C 00000049	0:00:40	0:01:15	0:01:27	0:03:27	0:10:43	3	Chesapeake Bay
	KMOTXT1C 00000048	0:00:40	0:01:12	0:01:29	0:03:29	0:10:51	3	Chesapeake Bay
	KMOTXT1C 00000051	0:00:40	0:01:18	0:01:30	0:03:30	0:10:54	3	Chesapeake Bay
	KMOTXT1C 00000050	0:00:40	0:01:15	0:01:32	0:03:32	0:10:57	3	Chesapeake Bay
	KMOTXT1C 00000053	0:00:40	0:01:21	0:01:33	0:03:33	0:11:00	3	Chesapeake Bay
8	KMOTXT1C 00000052	0:00:40	0:01:18	0:01:35	0:03:35	0:11:03	3	Chesapeake Bay
	KMOTXT1C 00000055	0:00:40	0:01:24	0:01:36	0:03:36	0:11:06	3	Chesapeake Bay
	KMOTXT1C 00000054	0:00:40	0:01:21	0:01:38	0:03:38	0:11:09	3	Chesapeake Bay
	KMOTXT1C 00000057	0:00:40	0:01:27	0:01:39	0:03:39	0:11:12	3	Chesapeake Bay
	KMOTXT1C 00000056	0:00:40	0:01:24	0:01:41	0:03:41	0:11:15	3	Chesapeake Bay
	KMOTXT1C 00000059	0:00:40	0:01:30	0:01:42	0:03:42	0:11:18	3	Chesapeake Bay
	KMOTXT1C 00000058	0:00:40	0:01:27	0:01:44	0:03:44	0:11:21	3	Chesapeake Bay
	KMOTXT1C 00000061	0:00:40	0:01:33	0:01:45	0:03:45	0:11:24	3	Chesapeake Bay
	KMOTXT1C 00000060	0:00:40	0:01:30	0:01:47	0:03:47	0:11:32	3	Chesapeake Bay
	KMOTXT1C 00000063	0:00:40	0:01:36	0:01:48	0:03:48	0:11:35	3	Chesapeake Bay
	KMOTXT1C 00000062	0:00:40	0:01:33	0:01:50	0:03:50	0:11:38	3	Chesapeake Bay
	KMOTXT1C 00000065	0:00:40	0:01:39	0:01:51	0:03:51	0:11:41	3	Chesapeake Bay
	KMOTXT1C 00000064	0:00:40	0:01:36	0:01:53	0:03:53	0:11:44	3	Chesapeake Bay
	KMOTXT1C 00000067	0:00:40	0:01:42	0:01:54	0:03:54	0:11:47	3	Chesapeake Bay
	KMOTXT1C 00000066	0:00:40	0:01:39	0:01:56	0:03:56	0:11:50	3	Chesapeake Bay
	KMOTXT1C 00000069	0:00:40	0:01:45	0:01:57	0:03:57	0:11:53	3	Chesapeake Bay
	KMOTXT1C 00000068	0:00:40	0:01:42	0:01:59	0:03:59	0:11:56	3	Chesapeake Bay
	KMOTXT1C 00000071	0:00:40	0:01:48	0:02:00	0:04:00	0:11:59	3	Chesapeake Bay
	KMOTXT1C 00000070	0:00:40	0:01:45	0:02:02	0:04:02	0:12:02	3	Chesapeake Bay
	KMOTXT1C 00000073	0:00:40	0:01:51	0:02:03	0:04:03	0:12:05	3	Chesapeake Bay
	KMOTXT1C 00000072	0:00:40	0:01:48	0:02:05	0:04:05	0:12:12	3	Chesapeake Bay
	KMOTXT1C 00000075	0:00:40	0:01:54	0:02:06	0:04:06	0:12:15	3	Chesapeake Bay

	KMOTXT1C 00000074	0:00:40	0:01:51	0:02:08	0:04:08	0:12:18	3	Chesapeake Bay
	KMOTXT1C 00000077	0:00:40	0:01:57	0:02:09	0:04:09	0:12:21	3	Chesapeake Bay
	KMOTXT1C 00000076	0:00:40	0:01:54	0:02:11	0:04:11	0:12:24	3	Chesapeake Bay
	KMOTXT1C 00000079	0:00:40	0:02:00	0:02:12	0:04:12	0:12:27	3	Chesapeake Bay
	KMOTXT1C 00000078	0:00:40	0:01:57	0:02:14	0:04:14	0:12:30	3	Chesapeake Bay
	KMOTXT1C 00000081	0:01:20	0:02:03	0:02:15	0:04:15	0:12:33	3	Chesapeake Bay
	KMOTXT1C 00000080	0:00:40	0:02:00	0:02:17	0:04:17	0:12:36	3	Chesapeake Bay
	KMOTXT1C 00000083	0:01:20	0:02:06	0:02:18	0:04:18	0:12:39	3	Chesapeake Bay
	KMOTXT1C 00000082	0:01:20	0:02:03	0:02:20	0:04:20	0:12:42	3	Chesapeake Bay
	KMOTXT1C 00000085	0:01:20	0:02:09	0:02:21	0:04:21	0:12:45	3	Chesapeake Bay
	KMOTXT1C 00000084	0:01:20	0:02:06	0:02:23	0:04:23	0:12:53	3	Chesapeake Bay
	KMOTXT1C 00000087	0:01:20	0:02:12	0:02:24	0:04:24	0:12:56	3	Chesapeake Bay
	KMOTXT1C 00000086	0:01:20	0:02:09	0:02:26	0:04:26	0:12:59	3	Chesapeake Bay
	KMOTXT1C 00000089	0:01:20	0:02:15	0:02:27	0:04:27	0:13:02	3	Chesapeake Bay
	KMOTXT1C 00000088	0:01:20	0:02:12	0:02:29	0:04:29	0:13:05	3	Chesapeake Bay
	KMOTXT1C 00000091	0:01:20	0:02:18	0:02:30	0:04:30	0:13:08	3	Chesapeake Bay
	KMOTXT1C 00000090	0:01:20	0:02:15	0:02:32	0:04:32	0:13:11	3	Chesapeake Bay
	KMOTXT1C 00000093	0:01:20	0:02:21	0:02:33	0:04:33	0:13:14	3	Chesapeake Bay
	KMOTXT1C 00000092	0:01:20	0:02:18	0:02:35	0:04:35	0:13:17	3	Chesapeake Bay
8	KMOTXT1C 00000095	0:01:20	0:02:24	0:02:36	0:04:36	0:13:20	3	Chesapeake Bay
	KMOTXT1C 00000094	0:01:20	0:02:21	0:02:38	0:04:38	0:13:23	3	Chesapeake Bay
	KMOTXT1C 00000097	0:01:20	0:02:27	0:02:39	0:04:39	0:13:26	3	Chesapeake Bay
	KMOTXT1C 00000096	0:01:20	0:02:24	0:02:41	0:04:41	0:13:32	3	Chesapeake Bay
	KMOTXT1C 00000099	0:01:20	0:02:30	0:02:42	0:04:42	0:13:35	3	Chesapeake Bay
	KMOTXT1C 00000098	0:01:20	0:02:27	0:02:44	0:04:44	0:13:38	3	Chesapeake Bay
	KMOTXT1C 00000100	0:01:20	0:02:30	0:02:47	0:04:47	0:13:41	3	Chesapeake Bay

3.2.3.4 Screen Captures of Input Windows for Containers via Flatbed Trucks

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report for the **basecont_truck.rd** scenario. The inputs used are identified by the letters a...m, which also correspond to the labels used in the equations presented in Section 3.2.3.2.



Flatbed Timing Parameters

	TIME		ONE HALF RANGE (+/-)	
	Minutes	Seconds	Minutes	Seconds
d Gate Processing Time:	3.00	0.00	0.00	0.00
Transit To End Ramps:	2.00	0.00	0.00	0.00
e Transit To Container Handlers:	3.00	0.00	0.00	0.00
Remove Flatbed Tiedowns:	3.00	0.00	0.00	0.00
Offload Vehicle at End Ramp:	3.00	0.00	0.00	0.00
Offload Vehicle With Crane:	5.00	0.00	0.00	0.00
f Offload Container at Container Handler:	5.00	0.00	0.00	0.00

To update values in the table above, select
the appropriate cell in the table. Then,
enter the new value here and hit Return.

New Value:

Container Timing Parameters

X

	TIME		ONE HALF RANGE (+/-)	
	Minutes	Seconds	Minutes	Seconds
g Open Staging Parking:	4.00	0.00	0.00	0.00
k Transit Container To Berth:	2.00	0.00	0.00	0.00
Load Container At RORO Berth:	4.00	0.00	0.00	0.00
l Load Container At Container Berth:	3.00	0.00	0.00	0.00
h Required Dwell Time In Open Staging:	120.00	0.00	0.00	0.00

To Update values in the table above, select the appropriate cell in the table. Then, enter the new value here and hit Return.

New Value:

Ship Parameters

Ship: 1 Of 1

NISC: 00010 Stow Factor:

Ship Name: Chesapeake Bay Trip Number: 1

Generic Type: Container NSS (Slow)

Fleet Description: Sea-RdyPgm

Speed (knots): 19.000000 Length (ft):

Beam (ft): 106 Boom (ft): 10

Draft (ft):

Maximum Capacities By Cargo Type:

Breakbulk (MTONS): Container (Sq. Ft.):
RORO (Sq. Ft.):

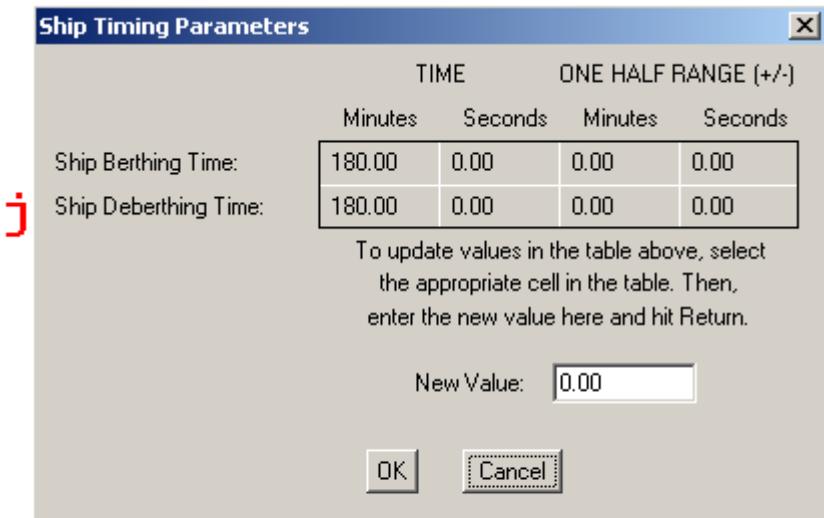
Self Sustaining:

Vehicle Loading Time (minutes)

Vehicle Loading Time Standard Dev. (minutes)

Maximum Time Ship Will Wait Without
Loading/Offloading an Item Prior to Departing (hrs.):

i Ship Arrival Time To Port
(Deterministic Arrival Mode Only) in Hours:



Berth Detailed Parameters

Berth: 1 Of 6

Berth Name: Berth 1

Length (ft):	842	Number of Container Cranes:	1
Depth Alongside At Mean Low Water (ft):	42	Number of Wharf Cranes:	1
Deck Strength:	1000	M aximum Call Forward:	12
Apron Width:	110	Deck Construction:	Concrete
Apron Length Served By Rail (ft):	842	Fendering:	
Apron Height Above Mean Low Water (ft):	15		
Previous Contiguous Berth:	NA		
Next Contiguous Berth:	Berth 2		

Available For Military Use

[Previous Berth](#) [Next Berth](#)

[Save Data](#) [Done](#)

3.2.3.5 PORTSIM Menu Inputs for Containers via Flatbed Trucks

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report for the **basecont_truck.rd** scenario (and, in general, for containers via flatbed trucks loaded on a container ship). The order presented starts with the Time Arrived at Port, Time Parked in Staging, left to right, ending with the Loading Rate. The letters a...m are labels for the input variables as shown in the screen captures (Section 3.2.3.4).

Time Arrived at Port

Parameters > Modify Arrival Mode Time Parameters > Flatbeds
Number of Flatbeds per Group = a
Time to Begin Simulating Arrivals = b
Time Between Arrivals = c

Time Cleared Gate

Parameters > Modify Process Timing Parameters > Flatbed
Gate Processing = d

Time Parked in Staging

Parameters > Modify Process Timing Parameters > Flatbed
Transit to Container Handlers = e
Offload Container at Container Handler = f

Parameters > Modify Process Timing Parameters > Container
Open Staging Parking = g

Time Available to Load

Parameters > Modify Process Timing Parameters > Container
Required Dwell Time in Open Staging = h

Time Loaded

Parameters > Modify Ship Parameters
Ship Arrival Time to Port = i

Parameters > Modify Process Timing Parameters > Ship
Ship Berthing Time = j

Parameters > Modify Process Timing Parameters > Container
Transit Container to Berth = k
Load Container at Container Berth = l

Parameters > Modify Port Parameters > Berth Parameters
 Maximum Call Forward = m

Load Rate

Parameters > Modify Process Timing Parameters > Container
 Load Container at Container Berth = 1

3.2.4 Helicopters, Residual Equipment, and Watercraft

3.2.4.1 Diagram of Helicopters, Residual Equipment, and Watercraft

Figure 6 shows the pathway of helicopters, residual equipment, and watercraft.

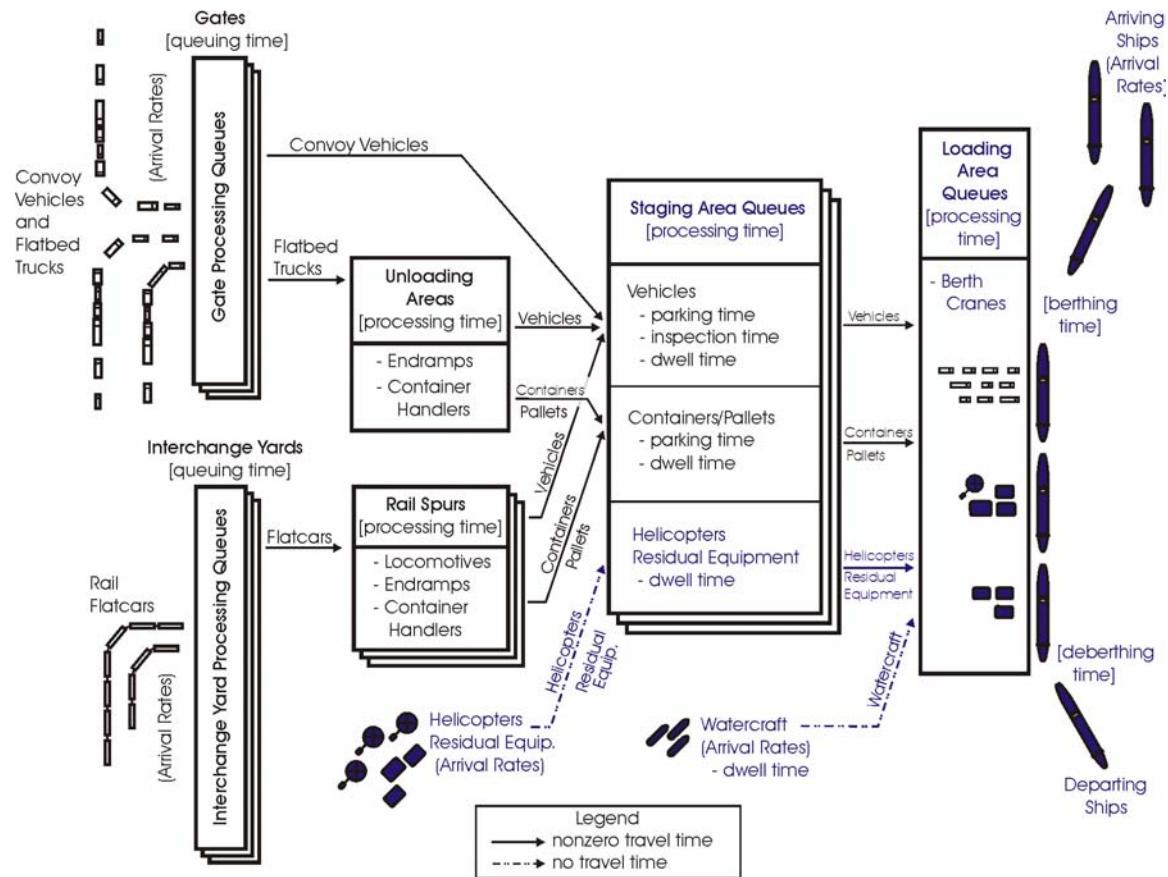


FIGURE 6 Pathway of Helicopters, Residual Equipment, and Watercraft

3.2.4.2 Tracking Sequence for Helicopters, Residual Equipment, and Watercraft

This section presents the equations and logic that reproduce the results of the Cargo Report for the **heli_res_wat.rd** scenario using the **heli_res_wat.lst** force file (Section 3.2.4.3). First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report. The order presented follows the order of the Cargo Report columns from left to right.

As an example of computing the Time Loaded (TL) for the first, second, and third cargo items, the TL of the first cargo item is equal to the time for the ship to arrive at port plus the time to berth the ship plus the time to load a helicopter on a ship. The TL of the second cargo item is equal to the first cargo item TL plus the time to load a helicopter on a ship. The TL of the third cargo item is equal to the second cargo item TL plus the time to load a helicopter on a ship. Section 3.2.4.4 contains screen captures of all the defined input variables a...r used below.

Notation

N = total number of cargo pieces in the force file

$n \in 1,2,\dots,N$

$a\dots r$ = input variables used in PORTSIM (The sequence a...r excludes n as it is reserved for other notation.)

\wedge = results from previous step (i.e., from the previous cargo item within the same column of the Cargo Report)

Time Arrived at Port = TAP = $f(a, b, c, d, e, f, g, h, i)$

a = Number of Helicopters per Group

b = Time to Begin Simulating Arrivals (Helicopters)

c = Time Between Arrivals (Helicopters)

d = Number of Residual Equipment per Group

e = Time to Begin Simulating Arrivals (Residual Equipment)

f = Time Between Arrivals (Residual Equipment)

g = Number of Watercraft per Group

h = Time to Begin Simulating Arrivals (Watercraft)

i = Time Between Arrivals (Watercraft)

The helicopters arrive at port in groups of “ a ” helicopters, with the first group arriving at time “ b .” The time separation between groups of helicopters is equal to a fixed interval of “ c ” hours. All cargo items arriving in the same group are assigned the same Time Arrived at Port.

The residual equipment arrives at port in groups of “ d ” pieces of residual equipment, with the first group arriving at time “ e .” The time separation between groups of residual equipment is equal to a fixed interval of “ f ” hours. All cargo items arriving in the same group are assigned the same Time Arrived at Port.

The watercraft arrive at port in groups of “g” watercraft, with the first group arriving at time “h.” The time separation between groups of watercraft is equal to a fixed interval of “i” hours. All cargo items arriving in the same group are assigned the same Time Arrived at Port.

Time Cleared Gate = TCG

Helicopters and residual equipment arrive at port and immediately enter the staging area, bypassing any gate processing. Watercraft are handled in a similar way, but additionally bypass staging area processing. For these reasons, the TCG column contains NA (not applicable) values.

Time Parked in Staging = TPS

Helicopters and residual equipment arrive at the port and immediately enter the staging area; therefore, no time elapses from the arrival of cargo at port (TAP) to the parking of cargo in the staging area (TPS). If the staging area has insufficient space, however, the cargo remains outside the gate until sufficient space becomes available. Watercraft bypass the staging area processing, and so this equipment contains NA values in the TPS column. The staging for watercraft does not occupy physical space, but is held in a “virtual” staging area.

If the cargo type is a helicopter or residual equipment, $TPS_i = TAP_i$.

If the cargo type is watercraft, $TPS_i = NA$.

As already noted with the cargo types, helicopters, residual equipment, and watercraft, PORTSIM does not explicitly model arrival processing, transport to staging, parking of cargo, staging area processing (for watercraft only), and other miscellaneous processes. It is up to the user to account for these processes in the dwell time parameters.

Time Available to Load = TAL = $f(TPS, j, k, l)$

j = Cargo Open Staging Dwell Times (Helicopters)

k = Cargo Open Staging Dwell Times (Watercraft)

l = Cargo Open Staging Dwell Times (Residual Equipment)

If the cargo type is a helicopter, $TAL_n = TPS_n + j$.

If the cargo type is watercraft, $TAL_n = TPS_n + k$.

If the cargo type is residual equipment, $TAL_n = TPS_n + l$.

Time Loaded = TL = $f(m, o, p, q, r)$

m = Ship Arrival Time to Port in Hours

o = Ship Berthing Time

p = Loading Time (Helicopters)

q = Loading Time (Watercraft)

r = Loading Time (Residual Equipment)

PORTSIM prioritizes loading of cargo as follows: helicopters, residual equipment, and finally watercraft. In scenario **heli_res_wat.rd**, one helicopter, one piece of residual equipment, and one watercraft are the first cargo items available for loading and are available at hour 00:03:00. PORTSIM will choose to load the helicopter first. The helicopter is loaded by hour 00:10:30. By hour 00:10:30, however, all cargo items of the force are available to load. Using the prioritization noted above, PORTSIM will load all of the helicopters first (one at a time), followed by all of the residual equipment (one at a time), and finally by all of the watercraft (one at a time), producing the following pattern:

$$TAL_1 = m + o + p$$

$$TAL_2 = ^\wedge + p$$

...

$$TAL_5 = ^\wedge + p$$

$$TAL_6 = ^\wedge + r$$

$$TAL_7 = ^\wedge + r$$

...

$$TAL_{10} = ^\wedge + r$$

$$TAL_{11} = ^\wedge + q$$

$$TAL_{12} = ^\wedge + q$$

...

$$TAL_{15} = ^\wedge + q$$

Loading Time = LT = f (p, q, r)

p = Loading Time (Helicopters)

q = Loading Time (Watercraft)

r = Loading Time (Residual Equipment)

If cargo type is a helicopter, $LT_n = p$.

If cargo type is watercraft, $LT_n = q$.

If cargo type is residual equipment, $LT_n = r$.

3.2.4.3 Cargo Report Output for Helicopters, Residual Equipment, and Watercraft

This section contains a printout of the Cargo Report for the **heli_res_wat.rd** scenario using the **heli_res_wat.lst** force file. The Cargo Report is sorted according to the TL column to better display the patterns and logic. The equations from Section 3.2.4.2 are written in some of the cells of the Cargo Report.

Scenario Name: heli_res_wat.rd

Sorted by Time Loaded

PORTSIM Detailed Cargo Report

(Note: All Times Are Represented In DDD:HH:MM)

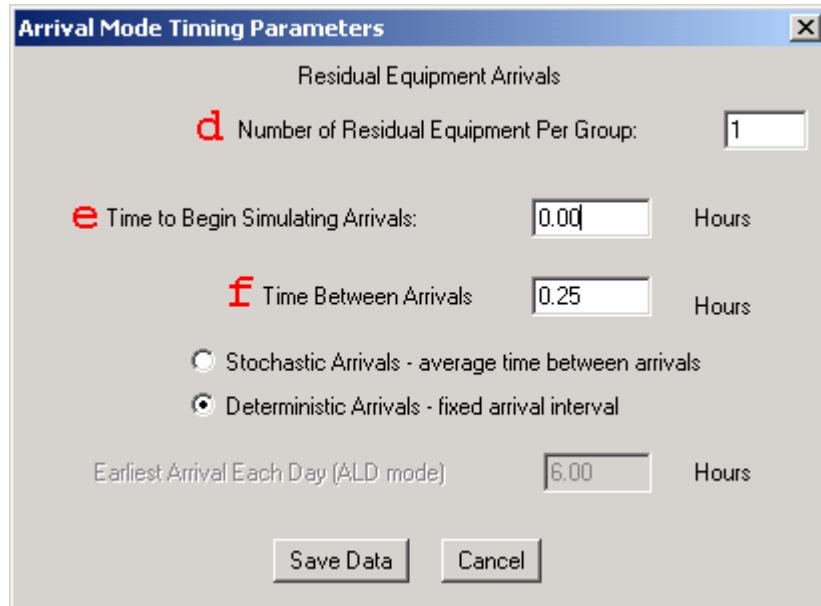
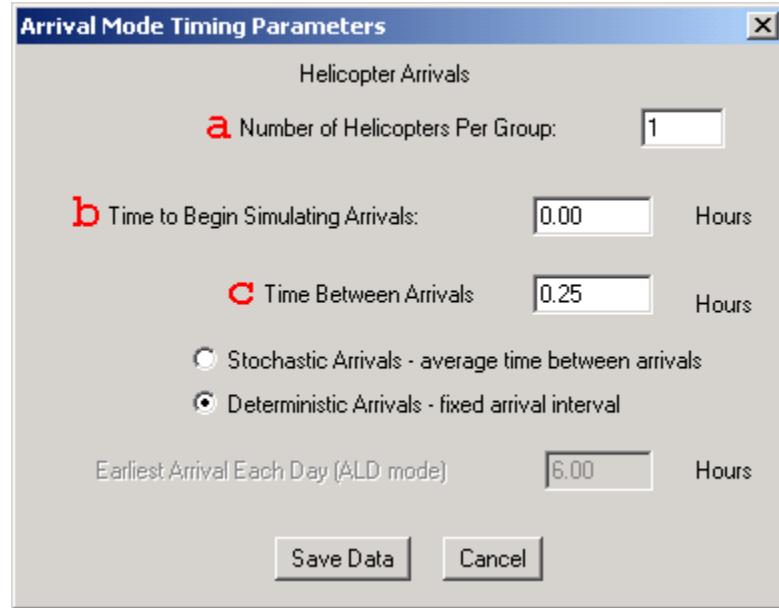
Sort Instructions: To sort on a desired column, double-click the column header and the table will be sorted by that column.

Cargo ^a	LIN ID	TAP		TCG		TPS		TAL		TL		LT	
		Time Arrived At Port	Cleared Gate	Time	Parked In Staging	Time Available To Load	Time Loaded	Loading Time (Mins)	Ship Loaded Onto				
HELICOPTER	a ARM2001EQ00000109	0:00:00	TAP ₁	NA	0:00:00	TAP ₁	0:03:00	TPS _{1+j}	0:10:30	m+o+p	150	p	Algol
	ARM2001EQ00000109	0:00:15	TAP ₂	NA	0:00:15	TAP ₂	0:03:15	TPS _{2+j}	0:13:00	^+p	150	p	Algol
	ARM2001EQ00000109	0:00:30	TAP ₃	NA	0:00:30	TAP ₃	0:03:30		0:15:30		150		Algol
	ARM2001EQ00000109	0:00:45	.	NA	0:00:45	.	0:03:45		0:18:00		150		Algol
	ARM2001EQ00000109	0:01:00	.	NA	0:01:00	.	0:04:00		0:20:30		150		Algol
RESIDUAL EQUIPMENT	d ARM 1EQ00001427	0:00:00		NA	0:00:00		0:03:00	TPS _{6+l}	1:00:00	^+r	210	r	Algol
	ARM 1EQ00001427	0:00:15		NA	0:00:15		0:03:15	TPS _{7+l}	1:03:30	^+r	210	r	Algol
	ARM 1EQ00001427	0:00:30	> f	NA	0:00:30		0:03:30		1:07:00		210		Algol
	ARM 1EQ00001427	0:00:45		NA	0:00:45		0:03:45		1:10:30		210		Algol
	ARM 1EQ00001427	0:01:00		NA	0:01:00		0:04:00		1:14:00		210		Algol
WATERCRAFT	g FPM1326EQ00001789	0:00:00		NA	NA	0:03:00	TPS _{11+k}	1:21:00	^+q	420	q	Algol	
	FPM1326EQ00001789	0:00:15		NA	NA	0:03:15	TPS _{12+k}	2:04:00	^+q	420	q	Algol	
	FPM1326EQ00001789	0:00:30	> i	NA	NA	0:03:30		2:11:00		420		Algol	
	FPM1326EQ00001789	0:00:45		NA	NA	0:03:45		2:18:00		420		Algol	
	FPM1326EQ00001789	0:01:00		NA	NA	0:04:00		3:01:00		420		Algol	

a This column was added by the authors to identify the cargo types.

3.2.4.4 Screen Captures of Input Windows for Helicopters, Residual Equipment, and Watercraft

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report for the **heli_res_wat.rd** scenario. The inputs used are identified by the letters a...r, and these also correspond to labels used in the equations presented in Section 3.2.4.2.



Arrival Mode Timing Parameters

Watercraft Arrivals

g Number of Watercraft Per Group:

h Time to Begin Simulating Arrivals: Hours

i Time Between Arrivals: Hours

Stochastic Arrivals - average time between arrivals
 Deterministic Arrivals - fixed arrival interval

Earliest Arrival Each Day (ALD mode) Hours

Save Data **Cancel**

Process Timing Parameters

Cargo Open Staging Dwell Times

Dwell Time 1/2 Range (+/-)

	Mins	Mins
Vehicles:	<input type="text" value="1440.00"/>	<input type="text" value="0.00"/>
Containers:	<input type="text" value="1440.00"/>	<input type="text" value="0.00"/>
j Helicopters:	<input type="text" value="180.00"/>	<input type="text" value="0.00"/>
k Watercraft:	<input type="text" value="180.00"/>	<input type="text" value="0.00"/>
l Residual Equipment:	<input type="text" value="180.00"/>	<input type="text" value="0.00"/>
Pallets:	<input type="text" value="0.00"/>	<input type="text" value="0.00"/>

OK **Cancel**



Ship Parameters

Ship: 1 Of 1

Ship Name:	Algol	Stow Factor:	0.82
Generic Type:	RORO	Trip Number:	1
Class:	FSS	Length (ft):	946
Beam (ft):	106	Draft (ft):	37

Maximum Capacities By Cargo Type (Sq. Ft.):

RORO:	204179	Container:	36000	Breakbulk:	0
-------	--------	------------	-------	------------	---

Self Sustaining:

Ship Accepts:

Vehicles Containers Pallets Helicopters Residual Equipment Watercraft

Cargo Loading Times

	Loading Time Mins	1/2 Range (+/-) Mins		Loading Time Mins	1/2 Range (+/-) Mins	
Vehicles (RORO)	3.50	0.00	P	Helicopters	150.00	0.00
Vehicles (LOLO)	3.50	0.00	Q	Watercraft	420.00	0.00
Containers	4.00	0.00	R	Residual Equipment	210.00	0.00
Pallets	3.00	0.00				

*** NOTE: Ship Loading Times Global Editor Available Under
Modify Process Timing Parameters Menu Item

Maximum Wait Without Loading Before Departing Ship Arrival Time To Port In Hours
(User Specifies Exact Arrival Time Mode)

User Specified Berth Assignment

Available	Add ->	Selected	Priority Implied By Order
<input type="button" value=""/>	<input type="button" value="Add ->"/>	<input type="button" value=""/>	
	<input type="button" value="<- Remove"/>		

3.2.4.5 PORTSIM Menu Inputs for Helicopters, Residual Equipment, and Watercraft

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report for the **heli_res_wat.rd** scenario (and, in general, for helicopters, residual equipment, and watercraft loaded on a ship). The order presented starts with the Time Arrived at Port, Time Cleared Gate, left to right, and ends with the Loading Time. The letters a...r are labels for the input variables as shown in the screen captures (Section 3.2.4.4).

Time Arrived at Port

Parameters > Modify Arrival Mode Time Parameters > Helicopters

Number of Helicopters per Group = a

Time to Begin Simulating Arrivals = b

Time Between Arrivals = c

Parameters > Modify Arrival Mode Time Parameters > Residual Equipment

Number of Residual Equipment per Group = d

Time to Begin Simulating Arrivals = e

Time Between Arrivals = f

Parameters > Modify Arrival Mode Time Parameters > Watercraft

Number of Watercraft per Group = g

Time to Begin Simulating Arrivals = h

Time Between Arrivals = i

Time Cleared Gate

Helicopters and residual equipment arrive at the port and immediately appear in the staging area, bypassing any gate processing. Watercraft bypass both gate and staging area processing. For these reasons, the TCG column contains NA (not applicable) values.

Time Parked in Staging

Same as Time Arrived at Port.

Time Available to Load

Parameters > Modify Process Timing Parameters > Cargo Open Staging Dwell Times

Helicopters = j

Watercraft = k

Residual Equipment = l

Time Loaded

Parameters > Modify Ship Parameters
Ship Arrival Time to Port in Hours = m

Parameters > Modify Process Timing Parameters > Ship
Ship Berthing Time = o

Parameters > Modify Ship Parameters
Loading Time Helicopters = p
Loading Time Watercraft = q
Loading Time Residual Equipment = r

Loading Time

Parameters > Modify Ship Parameters
Loading Time Helicopters = p
Loading Time Watercraft = q
Loading Time Residual Equipment = r

3.2.5 Vehicles via Flatbed Trucks

3.2.5.1 Diagram of Vehicles via Flatbed Trucks

Figure 7 shows the pathway of vehicles via flatbed trucks.

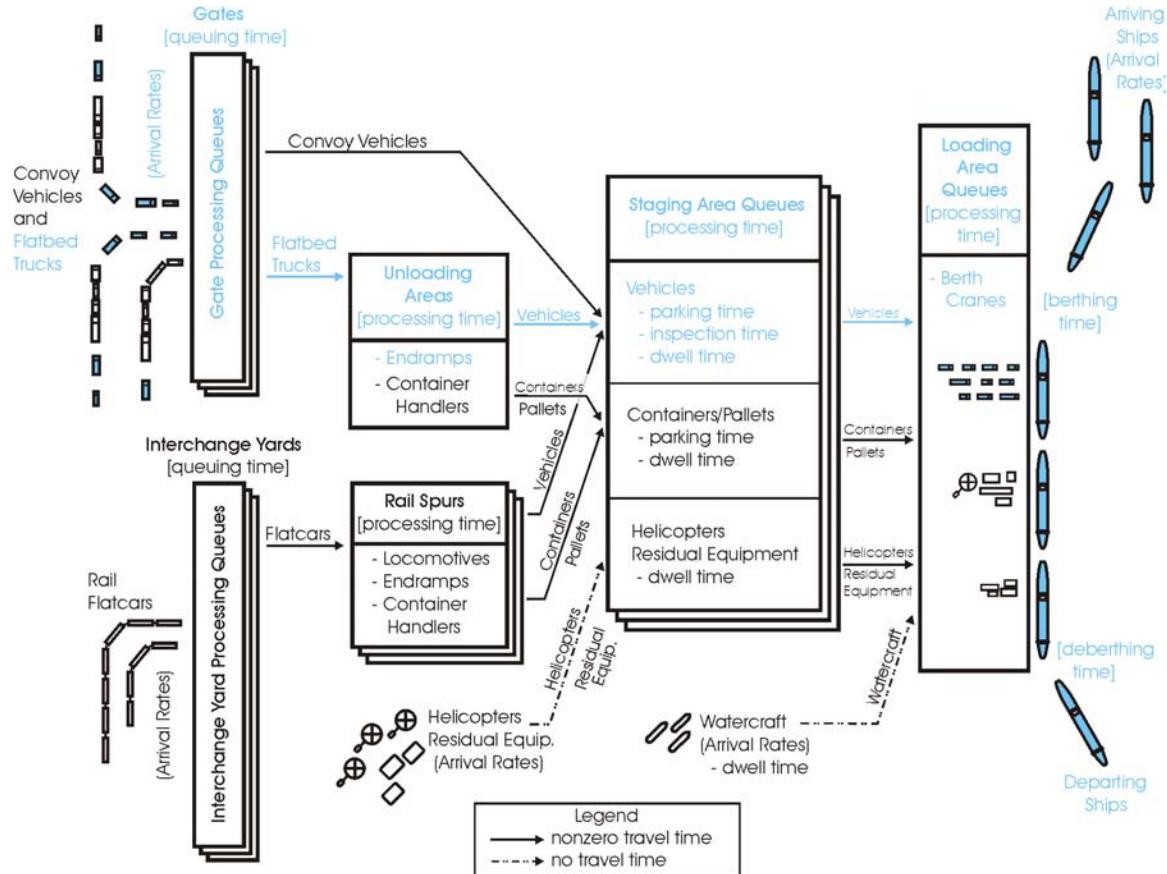


FIGURE 7 Pathway of Vehicles via Flatbed Trucks

3.2.5.2 Tracking Sequence for Vehicles via Flatbed Trucks

This section presents the equations and logic that reproduce the results of the Cargo Report for the **baseveh_truck.rd** scenario using the **veh_truck.lst** force file (Section 3.2.5.3). First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report. The order presented follows the order of the Cargo Report columns from left to right.

As an example of computing the Time Cleared Gate (TCG) for the first, second, and third cargo items, the first cargo item TCG is equal to the time for the first vehicle to arrive at the port plus the gate processing time. The second cargo item TCG is the same as the first vehicle because they are on the same flatbed truck. The third cargo item TCG is equal to the

second vehicle's TCG plus the gate processing time. Section 3.2.5.4 contains screen captures of all the defined input variables a...s used below.

Notation

- N = total number of cargo pieces in the force file
- $n \in 1, 2, \dots, N$
- a...s = input variables used in PORTSIM (The sequence a...s excludes n because it is reserved for other notation.)
- \wedge = results from the previous step (i.e., from the previous cargo item within the same column of the Cargo Report).

Time Arrived at Port = TAP = $f(a, b, c)$

- a = Number of Flatbeds per Group
- b = Time to Begin Simulating Arrivals
- c = Time Between Arrivals

The flatbed trucks arrive at the port in groups of “a” trucks, with the first group arriving at time “b.” The time separation between groups of flatbed trucks is equal to a fixed interval of “c” minutes. All cargo items arriving in the same group are assigned the same Time Arrived at Port.

Time Cleared Gate = TCG = $f(TAP, d)$

- d = Gate Processing Time

Each flatbed truck used in the force file, **veh_truck.lst**, holds two vehicles. For this reason, each pair of vehicles per flatbed truck will have the same TCG time.

$$\begin{aligned} TCG_1 &= TAP_1 + d \\ TCG_2 &= TCG_1 \\ TCG_3 &= \wedge + d \\ TCG_4 &= TCG_3 \\ \cdots \\ TCG_{N-1} &= \wedge + d \\ TCG_N &= TCG_{N-1} \end{aligned}$$

The equations above hold for the **baseveh_truck.rd** scenario. An exception to this formulation occurs when $TAP_{n+1} > TCG_n$. That is, the previous group of flatbeds has cleared the gate before the next group of flatbeds arrives to port, resulting in a forced wait time between the groups. When this occurs, use the following formulations:

$$\begin{aligned} TCG_{n+1} &= TAP_{n+1} + d \\ TCG_{n+2} &= TCG_{n+1} \\ TCG_{n+3} &= \wedge + d \end{aligned}$$

$$TCG_{n+4} = TCG_{n+3}$$

...

Time Parked in Staging = TPS = $f(TCG, e, f, g, h, i)$

e = Transit to End Ramp

f = Remove Flatbed Tiedowns

g = Offload Vehicle at End Ramp

h = Transit Vehicle Truck End Ramp to Open Staging

i = Open Staging Parking

The two vehicles per flatbed truck share the Transit to End Ramp and the Remove Flatbed Tiedowns times because they are on the same truck; however, the vehicles are offloaded one at a time. While the first vehicle is offloaded, the second vehicle waits, hence the 2g found in TPS_2 , TPS_4 ..., TPS_N formulations.

$$TPS_1 = TCG_1 + e + f + g + h + i$$

$$TPS_2 = TCG_1 + e + f + 2g + h + i$$

$$TPS_3 = TCG_3 + e + f + g + h + i$$

$$TPS_4 = TCG_3 + e + f + 2g + h + i$$

...

$$TPS_{N-1} = TCG_{N-1} + e + f + g + h + i$$

$$TPS_N = TCG_{N-1} + e + f + 2g + h + i$$

Figure 8 shows the typical order by LIN ID that the vehicles are offloaded from the flatbed trucks for the **baseveh_truck.rd scenario**. Two different patterns in the TPS occur when either Remove Flatbed Tiedowns or Offload Vehicles at End Ramp is set to large values (e.g., 30). These different patterns are correct and reproducible, and they are a result of operational dynamics and timing. The following two examples illustrate the differences that can occur.

Example 1: When Remove Flatbed Tiedowns is set to 48 minutes, interruptions and unusual gaps are observed, starting after the fourth vehicle (because two end ramps are used, which serve two flatbed trucks holding a total of four vehicles) and continue thereafter. The interruptions in time are caused by the unavailability of resources to offload vehicles from the flatbed trucks. In general, when $d < (f + 2g)/2$, interrupted offloading occurs. See Section 3.2.5.6 for more details.

Example 2: When Offload Vehicles at End Ramp is set to 48 minutes, the order in which vehicles are offloaded changes to a nonsequential offloading pattern as shown in Figure 9 (the numbers are the LIN ID). In general, when $g > d$, nonsequential offloading occurs. See Section 3.2.5.6 for more details.

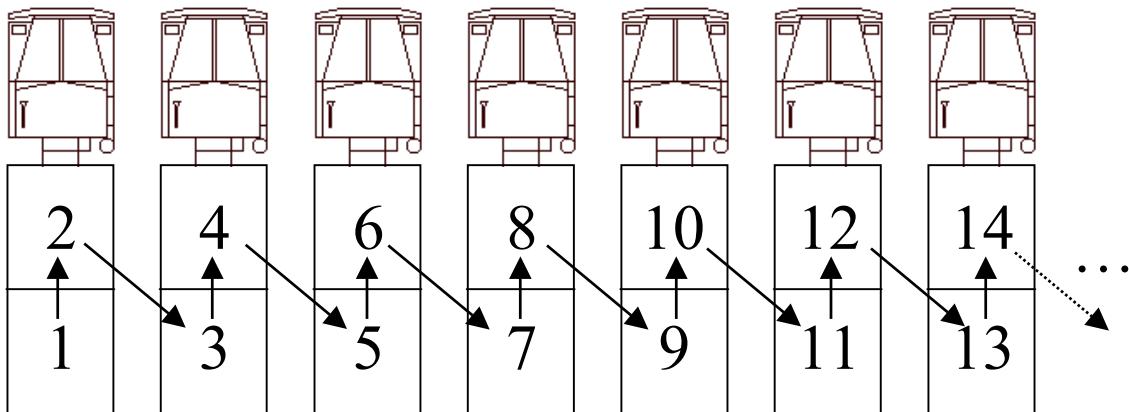


FIGURE 8 Typical Vehicle Offloading Order for the baseveh_truck.rd Scenario

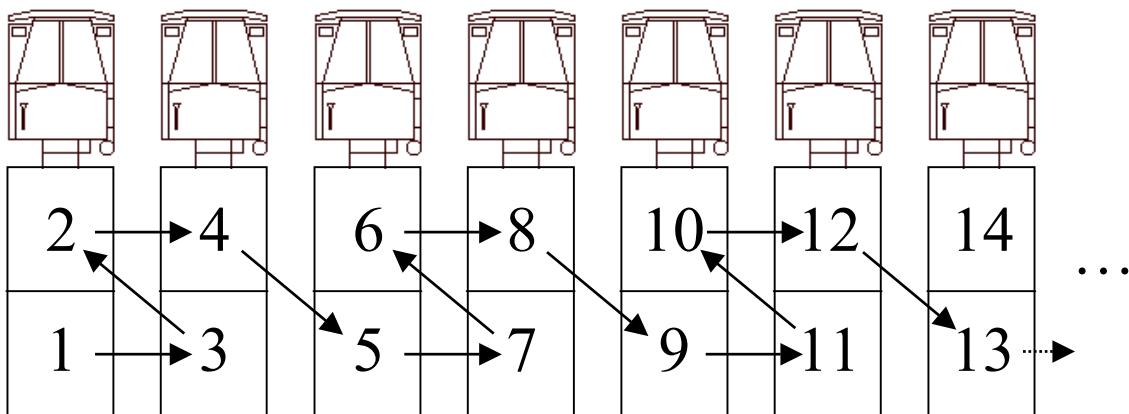


FIGURE 9 Vehicle Offloading Order for Large Values of the Offload Vehicles at End Ramp Parameter

Having outlined alternative patterns that can emerge in TPS, the tracking sequence proceeds as described below.

$$\text{Time Available to Load} = \text{TAL} = f(\text{TPS}, j, k)$$

j = Open Staging Inspection

k = Cargo Open Staging Dwell Times (Vehicles)

$$\text{TAL}_1 = \text{TPS}_1 + j + k$$

$$\text{TAL}_2 = \text{TPS}_2 + j + k$$

...

$$\text{TAL}_N = \text{TPS}_N + j + k$$

Time Loaded = TL = $f(l, m, o, p, q, r, s)$

l = Ship Arrival Time to Port
 m = Ship Berthing Time
 o = Transit Vehicle to Berth
 p = Cargo Loading Time - Vehicle (RORO)
 q = Cargo Loading Time - Vehicle (LOLO)
 r = Stevedore Process on Ship
 s = Maximum Call Forward
 Call Forward Group Lag Time = [0.25(s - 1)]

The CEIL function indicates rounding up of the argument.

$$\begin{aligned}
 TL_1 &= l + m + o + q + r + \text{CEIL} [0.25(s - 1)] \\
 TL_2 &= {}^{\wedge} + q \\
 \dots \\
 TL_{12} &= {}^{\wedge} + q \\
 \\
 TL_{13} &= l + m + o + q + r + \text{CEIL} [0.25(s - 1)] \\
 TL_{14} &= {}^{\wedge} + q \\
 \dots \\
 TL_{24} &= {}^{\wedge} + q \\
 \\
 TL_{25} &= l + m + o + p + r + \text{CEIL} [0.25(s - 1)] \\
 TL_{26} &= {}^{\wedge} + p \\
 \dots \\
 TL_{36} &= {}^{\wedge} + p \\
 \dots
 \end{aligned}$$

For the **baseveh_truck.rd** scenario, cargo items are loaded simultaneously onto a ship using three different loading operations. The three loading operations are ship cranes, berth cranes, and loading ramps. The first two Maximum Call Forward groups (Maximum Call Forward is explained in the paragraph below) are loaded using the LOLO (lift-on, lift-off) method via ship and berth cranes, and the third Maximum Call Forward group is loaded using the RORO method via loading ramps. The following pattern in the TL emerges for the 100 vehicles that are organized into eight Maximum Call Forward groups of size 12 and the last Maximum Call Forward group of the remaining four vehicles. In Table 2, the column labeled “Order of Loading” shows the relative loading sequence of groups of vehicles. The factors affecting this ordering are explained in the paragraphs following the table.

The Call Forward Group Lag Time is hard wired but also determined in part by the Maximum Call Forward value. For the **baseveh_truck.rd** scenario, the Maximum Call Forward is 12, meaning 12 cargo items are instantaneously called forward to be loaded onto the ship. The lag time between each item is 0.25 minutes. The first item starts traveling (from the staging area to the berth) at time zero, and the next 11 items, which complete the call forward, produce a total lag time of 2.75 minutes, the Call Forward Group Lag Time. Loading of the first item in the Maximum Call Forward group does not begin until the last

item in the Maximum Call Forward group reaches the berth. The Cargo Report displays time only to the minute and will always round up (CEIL function), therefore, converting the 2.75 minutes to 3 minutes for computing TL_1 , TL_{13} , and TL_{25} .

The Call Forward Group Lag Time also affects the gap in time between each Maximum Call Forward group (i.e., every 12 cargo items). Since there are three loading operations, however, these gaps appear between the following Maximum Call Forward groups: 3 and 4, 1 and 5, 2 and 6, ..., for the **baseveh_truck.rd** scenario.

TABLE 2 Relative Loading Sequence of Groups of Vehicles ^a

Maximum Call Forward Group	Cargo Items (LIN ID)	Loading Method	Loading Operation	Order of Loading
1	[1 – 12]	LOLO	Crane	2
2	[13 – 24]	LOLO	Crane	2
3	[25 – 36]	RORO	Ramp	1
4	[37 – 48]	RORO	Ramp	3
5	[49 – 60]	LOLO	Crane	4
6	[61 – 72]	LOLO	Crane	4
7	[73 – 84]	RORO	Ramp	5
8	[85 – 96]	LOLO	Crane	7
9	[97 – 100]	LOLO	Crane	6

^a The LOLO operations, whether by ship crane or berth crane, are not differentiated within the PORTSIM interface or output; rather, they are only differentiated in the code. Therefore, a “Crane” designation in the report can mean either a ship crane or a berth crane.

The formulation of the gap between the Maximum Call Forward groups can be either:

$$o + p + \text{CEIL}[0.25(s - 1)] \quad (\text{RORO})$$

or

$$o + q + \text{CEIL}[0.25(s - 1)] \quad (\text{LOLO}).$$

The two formulations arise from the two different cargo loading times for vehicles (RORO and LOLO). Because of rounding up and the different times for loading vehicles either RORO or LOLO, the gaps between Maximum Call Forward groups can be 7, 8, or 9 minutes. The last gap is smaller because the Maximum Call Forward group contains only four cargo items.

Loading Rate = LR = $f(p, q)$

p = Cargo Loading Time – Vehicles (RORO)

q = Cargo Loading Time – Vehicles (LOLO)

If the loading method is RORO, $LR_n = p$.

If the loading method is LOLO, $LR_n = q$.

3.2.5.3 Cargo Report Output for Vehicles via Flatbed Trucks

This section contains a printout of the Cargo Report for the **baseveh_truck.rd** scenario using the **veh_truck.lst** force file. The equations from Section 3.2.5.2 are written in some of the cells of the Cargo Report.

Scenario Name: baseveh_truck.rd

PORTSIM Detailed Cargo Report

(Note: All Times Are Represented In DDD:HH:MM)

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LIN ID	TAP		TCG		TPS		TAL		TL		LT	
	Time Arrived At		Time Cleared		Time Parked In		Time Available		Time Loaded		Loading Time	Ship Loaded
	Port	Gate	Staging	To Load							(Mins)	Onto
1	0:00:00	TAP ₁	0:00:15 TAP ₁ +d	0:00:30 TCG ₁ +e+f+g+h+i	0:01:55 TPS ₁ +j+k	0:13:11 l+m+o+q+r+CEIL[.25(s-1)]	4	q	Algol			
2	0:00:00	TAP ₂	0:00:15 TCG ₁	0:00:33 TCG ₁ +e+f+2g+h+i	0:01:58 TPS ₂ +j+k	0:13:15 ^ + q	4	q	Algol			
3	0:00:00	TAP ₃	0:00:30 ^ + d	0:00:45 TCG ₃ +e+f+g+h+i	0:02:10 TPS ₃ +j+k	0:13:19 ^ + q	4	q	Algol			
4	0:00:00	.	0:00:30 .	0:00:48 TCG ₃ +e+f+2g+h+i	0:02:13 .	0:13:23 .	4	.	Algol			
5	0:00:00	.	0:00:45 .	0:01:00 .	0:02:25 .	0:13:27 .	4	.	Algol			
6	0:00:00	.	0:00:45 .	0:01:03 .	0:02:28 .	0:13:31 .	4	.	Algol			
7	0:00:00		0:01:00	0:01:15 .	0:02:40 .	0:13:35 .	4		Algol			
8	0:00:00		0:01:00	0:01:18 .	0:02:43 .	0:13:39 .	4		Algol			
9	0:00:00		0:01:15	0:01:30 .	0:02:55 .	0:13:43 .	4		Algol			
10	0:00:00		0:01:15	0:01:33 .	0:02:58 .	0:13:47 .	4		Algol			
11	0:00:00		0:01:30	0:01:45 .	0:03:10 .	0:13:51 .	4		Algol			
12	0:00:00		0:01:30	b 0:01:48	0:03:13 .	0:13:55 .	4		Algol			
13	0:00:00		0:01:45	0:02:00 .	0:03:25 .	0:13:11 l+m+o+q+r+CEIL[.25(s-1)]	4		Algol			
14	0:00:00		0:01:45	0:02:03 .	0:03:28 .	0:13:15 ^ + q	4		Algol			
15	0:00:00		0:02:00	0:02:15 .	0:03:40 .	0:13:19 ^ + q	4		Algol			
16	0:00:00		0:02:00	0:02:18 .	0:03:43 .	0:13:23 .	4		Algol			
17	0:00:00		0:02:15	0:02:30 .	0:03:55 .	0:13:27 .	4		Algol			
18	0:00:00		0:02:15	0:02:33 .	0:03:58 .	0:13:31 .	4		Algol			
19	0:00:00		0:02:30	0:02:45 .	0:04:10 .	0:13:35 .	4		Algol			
20	0:00:00		0:02:30	c 0:02:48 .	0:04:13 .	0:13:39 .	4		Algol			
21	0:00:40		0:02:45	0:03:00 .	0:04:25 .	0:13:43 .	4		Algol			
22	0:00:40		0:02:45	0:03:03 .	0:04:28 .	0:13:47 .	4		Algol			
23	0:00:40		0:03:00	0:03:15 .	0:04:40 .	0:13:51 .	4		Algol			
24	0:00:40		0:03:00	0:03:18 .	0:04:43 .	0:13:55 .	4		Algol			
25	0:00:40		0:03:15	0:03:30 .	0:04:55 .	0:13:10 l+m+o+p+r+CEIL[.25(s-1)]	3	p	Algol			
26	0:00:40		0:03:15	0:03:33 .	0:04:58 .	0:13:13 ^ + p	3	p	Algol			
27	0:00:40		0:03:30	0:03:45 .	0:05:10 .	0:13:16 ^ + p	3	p	Algol			
28	0:00:40		0:03:30	0:03:48 .	0:05:13 .	0:13:19 .	3	.	Algol			
29	0:00:40		0:03:45	0:04:00 .	0:05:25 .	0:13:22 .	3	.	Algol			

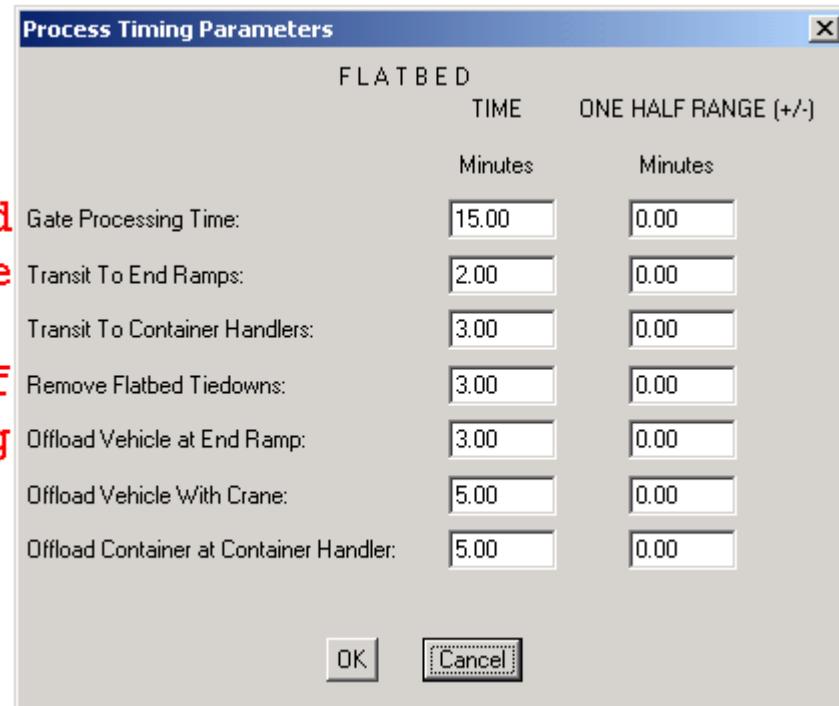
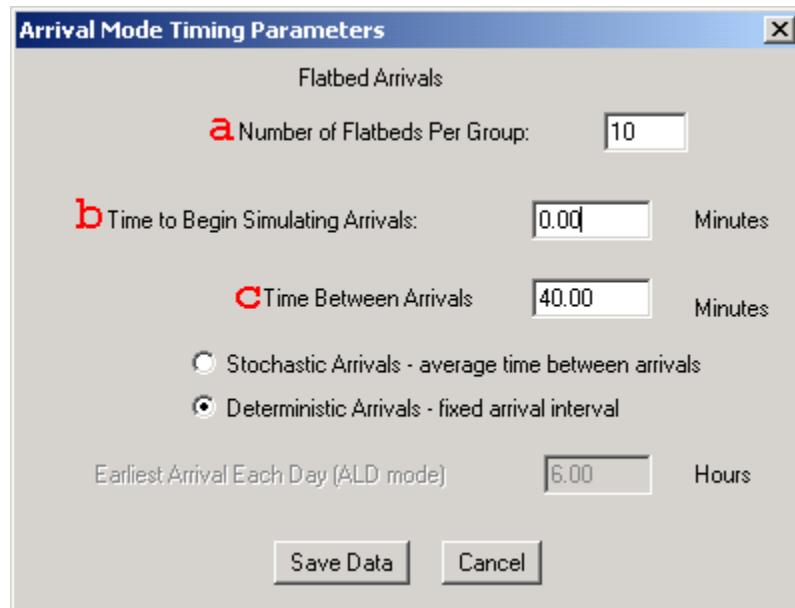
2a
↑
↓
b
c

30	0:00:40	0:03:45	0:04:03	0:05:28	0:13:25	3	Algol
31	0:00:40	0:04:00	0:04:15	0:05:40	0:13:28	3	Algol
32	0:00:40	0:04:00	0:04:18	0:05:43	0:13:31	3	Algol
33	0:00:40	0:04:15	0:04:30	0:05:55	0:13:34	3	Algol
34	0:00:40	0:04:15	0:04:33	0:05:58	0:13:37	3	Algol
35	0:00:40	0:04:30	0:04:45	0:06:10	0:13:40	3	Algol
36	0:00:40	0:04:30	0:04:48	0:06:13	0:13:43	3	Algol
37	0:00:40	0:04:45	0:05:00	0:06:25	0:13:51	3	Algol
38	0:00:40	0:04:45	0:05:03	0:06:28	0:13:54	3	Algol
39	0:00:40	0:05:00	0:05:15	0:06:40	0:13:57	3	Algol
40	0:00:40	0:05:00	0:05:18	0:06:43	0:14:00	3	Algol
41	0:01:20	>c 0:05:15	0:05:30	0:06:55	0:14:03	3	Algol
42	0:01:20	0:05:15	0:05:33	0:06:58	0:14:06	3	Algol
43	0:01:20	0:05:30	0:05:45	0:07:10	0:14:09	3	Algol
44	0:01:20	0:05:30	0:05:48	0:07:13	0:14:12	3	Algol
45	0:01:20	0:05:45	0:06:00	0:07:25	0:14:15	3	Algol
46	0:01:20	0:05:45	0:06:03	0:07:28	0:14:18	3	Algol
47	0:01:20	0:06:00	0:06:15	0:07:40	0:14:21	3	Algol
48	0:01:20	0:06:00	0:06:18	0:07:43	0:14:24	3	Algol
49	0:01:20	0:06:15	0:06:30	0:07:55	0:14:04	4	Algol
50	0:01:20	0:06:15	0:06:33	0:07:58	0:14:08	4	Algol
51	0:01:20	0:06:30	0:06:45	0:08:10	0:14:12	4	Algol
52	0:01:20	0:06:30	0:06:48	0:08:13	0:14:16	4	Algol
53	0:01:20	0:06:45	0:07:00	0:08:25	0:14:20	4	Algol
54	0:01:20	0:06:45	0:07:03	0:08:28	0:14:24	4	Algol
55	0:01:20	0:07:00	0:07:15	0:08:40	0:14:28	4	Algol
56	0:01:20	0:07:00	0:07:18	0:08:43	0:14:32	4	Algol
57	0:01:20	0:07:15	0:07:30	0:08:55	0:14:36	4	Algol
58	0:01:20	0:07:15	0:07:33	0:08:58	0:14:40	4	Algol
59	0:01:20	0:07:30	0:07:45	0:09:10	0:14:44	4	Algol
60	0:01:20	>c 0:07:30	0:07:48	0:09:13	0:14:48	4	Algol
61	0:02:00	>c 0:07:45	0:08:00	0:09:25	0:14:04	4	Algol
62	0:02:00	0:07:45	0:08:03	0:09:28	0:14:08	4	Algol
63	0:02:00	0:08:00	0:08:15	0:09:40	0:14:12	4	Algol
64	0:02:00	0:08:00	0:08:18	0:09:43	0:14:16	4	Algol
65	0:02:00	0:08:15	0:08:30	0:09:55	0:14:20	4	Algol
66	0:02:00	0:08:15	0:08:33	0:09:58	0:14:24	4	Algol
67	0:02:00	0:08:30	0:08:45	0:10:10	0:14:28	4	Algol
68	0:02:00	0:08:30	0:08:48	0:10:13	0:14:32	4	Algol

69	0:02:00	0:08:45	0:09:00	0:10:25	0:14:36	4	Algol
70	0:02:00	0:08:45	0:09:03	0:10:28	0:14:40	4	Algol
71	0:02:00	0:09:00	0:09:15	0:10:40	0:14:44	4	Algol
72	0:02:00	0:09:00	0:09:18	0:10:43	0:14:48	4	Algol
73	0:02:00	0:09:15	0:09:30	0:10:55	0:14:31	3	Algol
74	0:02:00	0:09:15	0:09:33	0:10:58	0:14:34	3	Algol
75	0:02:00	0:09:30	0:09:45	0:11:10	0:14:37	3	Algol
76	0:02:00	0:09:30	0:09:48	0:11:13	0:14:40	3	Algol
77	0:02:00	0:09:45	0:10:00	0:11:25	0:14:43	3	Algol
78	0:02:00	0:09:45	0:10:03	0:11:28	0:14:46	3	Algol
79	0:02:00	0:10:00	0:10:15	0:11:40	0:14:49	3	Algol
80	0:02:00	0:10:00	0:10:18	0:11:43	0:14:52	3	Algol
81	0:02:40	0:10:15	0:10:30	0:11:55	0:14:55	3	Algol
82	0:02:40	0:10:15	0:10:33	0:11:58	0:14:58	3	Algol
83	0:02:40	0:10:30	0:10:45	0:12:10	0:15:01	3	Algol
84	0:02:40	0:10:30	0:10:48	0:12:13	0:15:04	3	Algol
85	0:02:40	0:10:45	0:11:00	0:12:25	0:14:56	4	Algol
86	0:02:40	0:10:45	0:11:03	0:12:28	0:15:00	4	Algol
87	0:02:40	0:11:00	0:11:15	0:12:40	0:15:04	4	Algol
88	0:02:40	0:11:00	0:11:18	0:12:43	0:15:08	4	Algol
89	0:02:40	0:11:15	0:11:30	0:12:55	0:15:12	4	Algol
90	0:02:40	0:11:15	0:11:33	0:12:58	0:15:16	4	Algol
91	0:02:40	0:11:30	0:11:45	0:13:10	0:15:20	4	Algol
92	0:02:40	0:11:30	0:11:48	0:13:13	0:15:24	4	Algol
93	0:02:40	0:11:45	0:12:00	0:13:25	0:15:28	4	Algol
94	0:02:40	0:11:45	0:12:03	0:13:28	0:15:32	4	Algol
95	0:02:40	0:12:00	0:12:15	0:13:40	0:15:36	4	Algol
96	0:02:40	0:12:00	0:12:18	0:13:43	0:15:40	4	Algol
97	0:02:40	0:12:15	0:12:30	0:13:55	0:14:54	4	Algol
98	0:02:40	0:12:15	0:12:33	0:13:58	0:14:58	4	Algol
99	0:02:40	0:12:30	0:12:45	0:14:10	0:15:02	4	Algol
100	0:02:40	0:12:30	0:12:48	0:14:13	0:15:06	4	Algol

3.2.5.4 Screen Captures of Input Windows for Vehicles via Flatbed Trucks

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report for the **baseveh_truck.rd** scenario. The inputs used are identified by the letters a...s, and these also correspond to labels used in the equations presented in Section 3.2.5.2.



Process Timing Parameters

VEHICLES

	TIME	ONE HALF RANGE (+/-)
	Minutes	Minutes
Gate Processing:	3.00	0.00
Transit Vehicle Gate To Open Staging:	2.00	0.00
Transit Vehicle Rail End Ramp To Open Staging:	2.00	0.00
h Transit Vehicle Truck End Ramp To Open Staging:	2.00	0.00
j Open Staging Inspection:	25.00	0.00
i Open Staging Parking:	5.00	0.00
o Transit Vehicle To Berth:	2.00	0.00
r Stevedore Process On Ship:	2.00	0.00

OK **Cancel**

Process Timing Parameters

Cargo Open Staging Dwell Times

	Dwell Time	1/2 Range (+/-)
	Mins	Mins
k Vehicles:	60.00	0.00
Containers:	60.00	0.00
Helicopters:	180.00	0.00
Watercraft:	180.00	0.00
Residual Equipment:	180.00	0.00
Pallets:	0.00	0.00

OK **Cancel**

Ship Parameters

Ship: 1 Of 1

Ship Name:	Algol	Stow Factor:	0.82
Generic Type:	RORO	Trip Number:	1
Class:	FSS	Length (ft):	946
Beam (ft):	106	Draft (ft):	37

Maximum Capacities By Cargo Type (Sq. Ft.):

RORO:	204179	Container:	36000	Breakbulk:	0
-------	--------	------------	-------	------------	---

Self Sustaining:

Ship Accepts:

Vehicles Containers Pallets Helicopters Residual Equipment Watercraft

Cargo Loading Times

	Loading Time Mins	1/2 Range (+/-) Mins		Loading Time Mins	1/2 Range (+/-) Mins
Vehicles (RORO)	3.00	0.00	Helicopters	150.00	0.00
Vehicles (LOLO)	4.00	0.00	Watercraft	420.00	0.00
Containers	4.00	0.00	Residual Equipment	210.00	0.00
Pallets	3.00	0.00			

*** NOTE: Ship Loading Times Global Editor Available Under
Modify Process Timing Parameters Menu Item

> Maximum Wait Without Loading Before Departing Ship Arrival Time To Port In Hours (User Specifies Exact Arrival Time Mode)

User Specified Berth Assignment

Available	Add >	Selected
<input type="button" value=""/>	<input type="button" value="<- Remove"/>	<input type="button" value=""/>
Priority Implied By Order		

Process Timing Parameters

SHIP

TIME ONE HALF RANGE (+/-)

	Minutes	Minutes
m Ship Berthing Time:	180.00	0.00
Ship Deberthing Time:	180.00	0.00

OK **Cancel**

Berth Detailed Parameters

Berth Name: Berth 4 Berth: 4 Of 7

Length (ft):	1200	Number of Cranes:	1
Depth Alongside At Mean Low Water (ft):	42	S Maximum Call Forward:	12
Deck Strength:	1000	Deck Construction:	Concrete
Apron Width:	110	Fendering:	
Apron Length Served By Rail (ft):	1200		
Apron Height Above Mean Low Water (ft):	15		
Previous Contiguous Berth:	NA		
Next Contiguous Berth:	Berth 5		

Available For Military Use

Accepts the Following Types of Ships:

RORO Container Breakbulk Barge

Previous Berth **Next Berth**

Save Data **Done**

3.2.5.5 PORTSIM Menu Inputs for Vehicles via Flatbed Trucks

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report for the **baseveh_truck.rd** scenario (and, in general, for vehicles via flatbed trucks loaded on a ship). The order presented starts with the Time Arrived at Port, Time Cleared Gate, left to right, ending with the Loading Time. The letters a...s are labels for the input variables as shown in the screen captures (Section 3.2.5.4).

Time Arrived at Port

Parameters > Modify Arrival Mode Time Parameters > Flatbeds

Number of Flatbeds per Group = a

Time to Begin Simulating Arrivals = b

Time Between Arrivals = c

Time Cleared Gate

Parameters > Modify Process Timing Parameters > Flatbed

Gate Processing Time = d

Time Parked in Staging

Parameters > Modify Process Timing Parameters > Flatbed

Transit to End Ramp = e

Remove Flatbed Tiedowns = f

Offload Vehicle at End Ramp = g

Parameters > Modify Process Timing Parameters > Vehicle

Transit Vehicle Truck End Ramp to Open Staging = h

Open Staging Parking = i

Time Available to Load

Parameters > Modify Process Timing Parameters > Vehicle

Open Staging Inspection = j

Parameters > Modify Process Timing Parameters > Cargo Open Staging Dwell Times

Vehicles = k

Time Loaded

Parameters > Modify Ship Parameters

Ship Arrival Time to Port = l

Cargo Loading Time – Vehicle (RORO) = p

Cargo Loading Time – Vehicle (LOLO) = q

Parameters > Modify Process Timing Parameters > Ship
 Ship Berthing Time = m

Parameters > Modify Process Timing Parameters > Vehicle
 Transit Vehicle to Berth = o
 Stevedore Process on Ship = r

Parameters > Modify Port Parameters > Berth Parameters
 Maximum Call Forward = s

Loading Time

Parameters > Modify Ship Parameters
 Cargo Loading Time – Vehicle (RORO) = p
 Cargo Loading Time – Vehicle (LOLO) = q

3.2.5.6 Supplemental Observations for Time Parked in Staging for Vehicles via Flatbed Trucks

1. Details of the general case for the *interrupted offloading* are given as follows. The availability of a ramp (assuming a total of two end ramps) for a flatbed implies that flatbed_{n+2} is not ready to offload until after flatbed_n has completed offloading:

$$\begin{aligned} \text{TCG}_{n+2} + e &> \text{TCG}_n + e + f + 2g \\ \text{TCG}_{n+2} &> \text{TCG}_n + f + 2g \\ \text{TCG}_{n+1} + d &> \text{TCG}_n + f + 2g \\ \text{TCG}_n + d + d &> \text{TCG}_n + f + 2g \\ d + d &> f + 2g \\ d &> (f + 2g)/2 \text{ generalizes to } d > (f + 2g)/x, \text{ where } x = \text{number of end ramps} \end{aligned}$$

In general, interrupted offloading occurs when $d < (f + 2g)/x$.

2. Details of the general case for the *nonsequential offloading* are given as follows. Unloading of a flatbed truck, assuming availability of an end ramp, can begin at:

Flatbed _n	Vehicle ₁	TCG _n + e + f
Flatbed _n	Vehicle ₂	TCG _n + e + f + g
Flatbed _{n+1}	Vehicle ₁	TCG _{n+1} + e + f
Flatbed _{n+1}	Vehicle ₂	TCG _{n+1} + e + f + g

Nonsequential offloading exists when flatbed_{n+1} starts offloading before flatbed_n completes its offloading:

$$\begin{aligned} \text{TCG}_n + e + f + g &> \text{TCG}_{n+1} + e + f \\ \text{TCG}_n + g &> \text{TCG}_{n+1} \end{aligned}$$

$$\begin{aligned} \text{TCG}_n + g &> \text{TCG}_n + d \\ g &> d \end{aligned}$$

In general, nonsequential offloading occurs when $g > d$.

3.2.6 Containers via Flatcars

3.2.6.1 Diagram of Containers via Flatcars

Figure 10 shows the pathway of containers via flatcars.

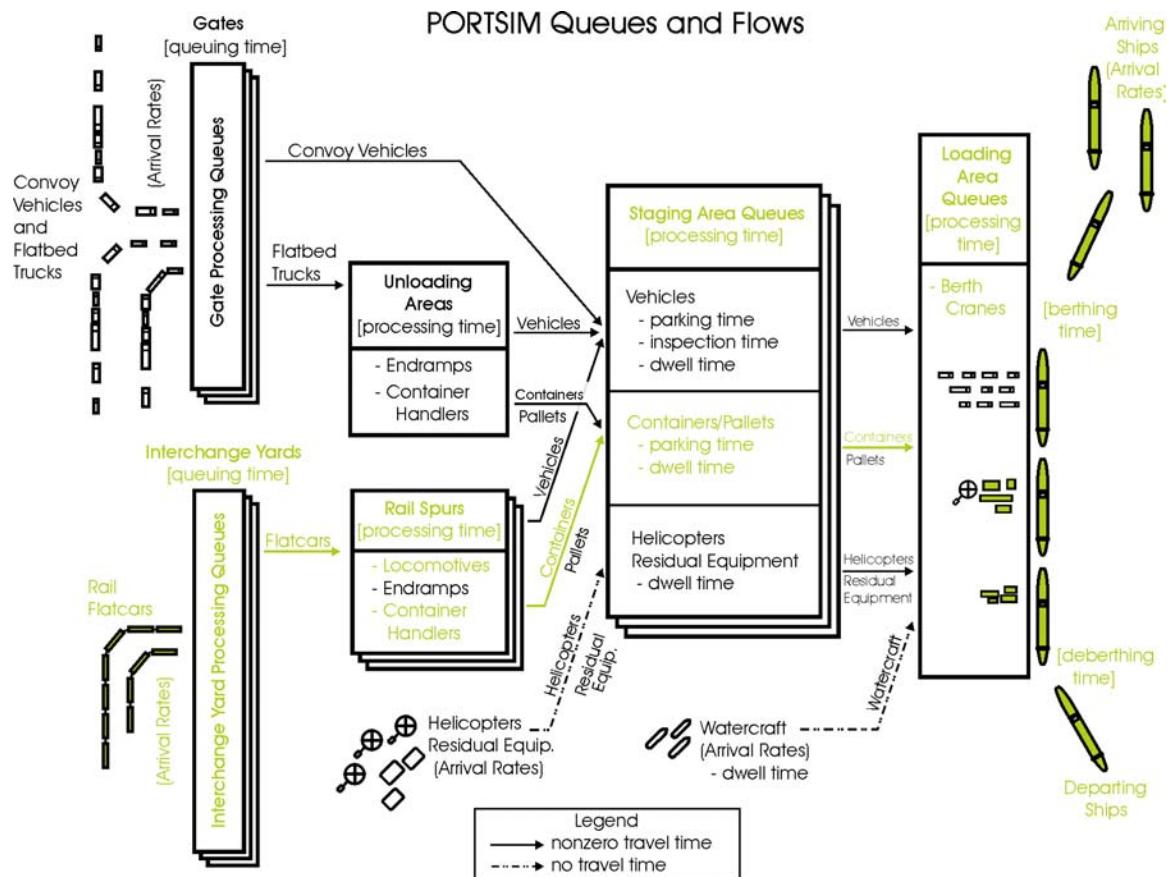


FIGURE 10 Pathway of Containers via Flatcars

3.2.6.2 Tracking Sequence for Containers via Flatcars

This section presents the equations and logic that reproduce the results of the Cargo Report and the Rail Timing File for the **basecont_rail.rd** scenario using the **contrail.lst** force file. First, a brief list of the notation is presented. Following that list are the equations and logic for computing the Cargo Report and the Rail Timing File. The order presented starts with the Time Arrived at Port, which is common to both the Cargo Report and the Rail Timing File. Next is Time Cleared Gate from the Cargo Report. The order then follows the ten data (left to right) from the Rail Timing File and finally picks up with the last four timing data (left to right) from the Cargo Report (i.e., Time Parked In Staging through the Loading Time). The Cargo Reports entries are shaded in gray.

As an example of computing the first and second container's Remove Tiedown (RT6) for the Rail Timing File, the RT6 of the first container is equal to the point in time at which the locomotive has been uncoupled at the spur plus the time to remove the tiedowns. The RT6 of the second container is equal to the previous results plus the time it takes to remove the tiedowns. Section 3.2.6.4 contains a screen capture of all the defined input variables a...t used below.

Notation

- N = total number of cargo pieces in the force file
 $n \in 1,2,\dots N$
 $a\dots t$ = input variables used in PORTSIM (The sequence a...t excludes n because it is reserved for other notation.)
 \wedge = results from previous step (i.e., from the previous cargo item within the same column of the Cargo Report or the Rail Timing File)

Time Arrived at Port = TAP = $f(a, b, c)$

- a = Number of Railcars per Train
 b = Time to Begin Simulating Arrivals
 c = Average Time Between Arrivals

Trains are of size “a” railcars. The first train arrives at the port at time “b.” The time separation between trains is equal to a fixed interval of “c” hours. All cargo items arriving on the same train are assigned the same Time Arrived at Port.

Time Cleared Gate = TCG

Trains arrive at port and then proceed directly to the interchange yard, bypassing any gate processing. For this reason, the TCG column contains NA (not applicable) entries.

Arrived at Interchange Yard = RT1 = $f(a, b, c)$

- a = Number of Railcars per Train
- b = Time to Begin Simulating Arrivals
- c = Average Time Between Arrivals

Only entire trains can enter the interchange yard. If the interchange yard has insufficient space for the entire train, the train is blocked from entering until adequate space becomes available. If this occurs, the Arrived at Interchange Yard will have a later time than the Time Arrived at Port. If a train is not blocked, the Time Arrived at Port will be the same as the Arrived at Interchange Yard.

Once the train arrives in the interchange yard, the concept of a “train” is replaced by a “string of flatcars.” A string of flatcars is a collection of flatcars, possibly from multiple trains as a result of processing at the interchange yard.

With the **basecont_rail.rd** test scenario and the **contrail.lst** force file, the string of flatcars size (10 flatcars) is the same as the train size (10 flatcars). In general, the numbers will not be the same. Rather, the number of flatcars in a string, which can vary in an execution, is the minimum of the number of flatcars accepted at the spur and the number of flatcars that have completed the interchange process (RT2).

Completed Interchange Yard Process = RT2 = $f(RT1, d)$

- d = Processing at Interchange Yard

$$RT2_i = RT1_i + d$$
$$i \in [1, N]$$

Coupled Locomotive at Interchange Yard = RT3 = $f(RT2, RT10, e, f)$

- e = Switch Spur to Interchange Yard
- f = Couple at Interchange Yard

First string of flatcars:

$$RT3_i = RT2_i + e + f$$
$$i \in [1, 4a]$$

Next string of flatcars:

$$RT3_j = RT10_{4a} + e + f$$
$$j \in [4a + 1, 8a]$$

Next string of flatcars:

$$RT3_k = RT10_{8a} + e + f$$
$$k \in [8a + 1, N]$$

The equations above hold for the **basecont_rail.rd** scenario. Two exceptions that can occur when using different input variables are described below.

Exception 1: If the locomotive is done (Uncouple Locomotive at Interchange Yard, RT10) with the previous string of flatcars before the next string of flatcars is ready to be coupled to the locomotive (Completed Interchange Yard Process, RT2), the locomotive waits until that string of flatcars completes its interchange yard processes. In this event, use the equation for the first string of flatcars as noted below.

If $RT10_{4a} < RT2_{4a+1}$, use the first string of flatcars equation.

If $RT10_{8a} < RT2_{8a+1}$, use the first string of flatcars equation.

Exception 2: When the number of flatcars called to the spur exceeds the number of flatcars per train, the flatcars from multiple trains will be grouped together into a string, provided enough flatcars are ready (RT2). An example of this case is seen in **basecont_rail.rd** when the time between trains arriving at port is reduced to two hours. Cargo items 41–80 arrive on one train and cargo items 81–100 on another train, yet all cargo items 41–100 are coupled together at the interchange yard (RT3) at the same time.

Arrived at Spur = RT4 = f(RT3, g)

g = Switch Interchange Yard to Spur

$$RT4_i = RT3_i + g \\ i \in [1, N]$$

Uncoupled Locomotive at Spur = RT5 = f(RT4, h)

h = Uncouple at Spur

$$RT5_i = RT4_i + h \\ i \in [1, N]$$

Removed Tiedown = RT6 = f(RT5, i)

i = Remove Flatcar Tiedowns

First string of flatcars:

$$RT6_1 = RT5_1 + i$$

$$RT6_2 = ^\wedge + i$$

...

$$RT6_{4a} = ^\wedge + i$$

Next string of flatcars:

$$RT6_{4a+1} = RT5_{4a+1} + i$$

$$RT6_{4a+2} = ^\wedge + i$$

...
 $RT6_{8a} = \wedge + i$

Next string of flatcars:

$RT6_{8a+1} = RT5_{8a+1} + i$
 $RT6_{8a+2} = \wedge + i$

...
 $RT6_N = \wedge + i$

Discharged from Flatcar = RT7 = f(RT6, j)

j = Discharge Container at Spur

First string of flatcars:

$RT7_1 = RT6_{4a} + j$
 $RT7_2 = \wedge + j$

...
 $RT7_{4a} = \wedge + j$

Next string of flatcars:

$RT7_{4a+1} = RT6_{8a} + j$
 $RT7_{4a+2} = \wedge + j$

...
 $RT7_{8a} = \wedge + j$

Next string of flatcars:

$RT7_{8a+1} = RT6_N + j$
 $RT7_{8a+2} = \wedge + j$

...
 $RT7_N = \wedge + j$

Tiedowns are removed from the entire string of flatcars before the containers are discharged.

Coupled Locomotive at Spur = RT8 = f(RT7, g, k)

g = Switch Interchange Yard to Spur
k = Couple at Spur

First string of flatcars:

$RT8_i = RT7_{4a} + g + k$
 $i \in [1, 4a]$

Next string of flatcars:

$RT8_j = RT7_{8a} + g + k$
 $j \in [4a + 1, 8a]$

Next string of flatcars:
 $RT8_k = RT7_N + g + k$
 $k \in [8a + 1, N]$

Arrived at Interchange Yard from Spur = RT9 = $f(RT8, e)$

e = Switch Spur to Interchange Yard

$$RT9_i = RT8_i + e$$

$$i \in [1, N]$$

Uncoupled Locomotive at Interchange Yard = RT10 = $f(RT9, l)$

l = Uncouple at Interchange Yard

$$RT10_i = RT9_i + l$$

$$i \in [1, N]$$

Time Parked in Staging = TPS = $f(RT7, m)$

m = Open Staging Parking

$$TPS_i = RT7_i + m$$

$$i \in [1, N]$$

The transit container from the spur to the open staging time needs to be incorporated in the Open Staging Parking time because that timing parameter does not exist as a separate user input.

Time Available to Load = TAL = $f(TPS, o)$

o = Cargo Open Staging Dwell Times (Containers)

$$TAL_i = TPS_i + o$$

$$i \in [1, N]$$

Time Loaded = TL = $f(p, q, r, s, t)$

p = Ship Arrival Time to Port
 q = Ship Berthing Time
 r = Transit Container to Berth
 s = Cargo Loading Times (Containers)
 t = Maximum Call Forward
 Call Forward Group Lag Time = $[0.25(t - 1)]$

The CEIL function indicates rounding up of the argument.

$$TL_1 = p + q + r + s + \text{CEIL}[0.25(t - 1)]$$

$$TL_2 = \wedge + s$$

...

$$TL_N = \wedge + s$$

Time Loaded is in part a function of the Maximum Call Forward. Maximum Call Forward is a berth characteristic that limits the maximum number of cargo items that can be called forward at one time. It affects the Time Loaded by loading the containers in groups equal to the Maximum Call Forward. For the **basecont_rail.rd** scenario, the Maximum Call Forward is set to 12, so containers are loaded in the following groups of 12: 1–12, 13–24, 25–36, 37–48, 49–60, 61–72, 73–84, 85–96, and then 97–100, which are the last remaining four containers.

The Maximum Call Forward is used to compute the Maximum Call Forward Group Lag Time. Twelve cargo items are instantaneously called forward. The lag time between each of the 12 cargo items is 0.25 minutes. The first cargo item starts traveling (from the staging area to the berth) at time zero, and the next 11 cargo items, which complete the call forward, produce a total lag time of 2.75 minutes, the Maximum Call Forward Group Lag Time. Loading of the first item in the call forward group does not begin until the last item in the Maximum Call Forward group reaches the berth. The Cargo Report reports time only to the minute and will always round up (CEIL function), thereby, converting the 2.75 minutes to 3 minutes for computing TL_1 .

The Maximum Call Forward Group Lag Time also affects the gap in time between each Maximum Call Forward group, i.e., every 12 cargo items. The formulation of the gap between the Maximum Call Forward groups is equal to the Transit Container to Berth plus the Cargo Loading Times (Containers) plus the ceiling on the Call Forward Group Lag Time, $r + s + \text{CEIL}[0.25(t - 1)]$. Because of rounding up, the gaps between call forward groups may be 8 or 9 minutes. The last gap is smaller because the call forward contains only four cargo items.

Loading Time = LT = f (s)

s = Cargo Loading Times (Containers)

$$LT_i = s$$

$$i \in [1, N]$$

3.2.6.3 Cargo Report and Rail Timing File Output for Containers via Flatcars

This section contains a printout of the Cargo Report and the Rail Timing File for the **basecont_rail.rd** scenario using the **contrail.lst** force file. The equations from Section 3.2.6.2 are written in some of the cells of the Cargo Report and the Rail Timing File.

Scenario Name: basecont_rail.rd
 PORTSIM Detailed Cargo Report

LIN ID	TAP	TCG	TPS	TAL	TL	LT	Ship Loaded Onto
	Time Arrived At Port	Time Cleared Gate	Time Parked In Staging	Time Available To Load	Time Loaded	Loading Time (Mins)	
KRAILC1C 00000001	0:00:00	NA	0:06:00 RT7₁+m	0:07:00 TPS₁+o	0:17:09 p+q+r+s+CEIL[0.25(t-1)]	4 s	Endurance
KRAILC1C 00000002	0:00:00	NA	0:06:05 RT7₂+m	0:07:05 TPS₂+o	0:17:13 ^ + s	4 s	Endurance
KRAILC1C 00000003	0:00:00	NA	0:06:10 RT7₃+m	0:07:10 TPS₃+o	0:17:17 ^ + s	4 s	Endurance
KRAILC1C 00000004	0:00:00	NA	0:06:15 .	0:07:15 .	0:17:21 .	4 .	Endurance
KRAILC1C 00000005	0:00:00	NA	0:06:20 .	0:07:20 .	0:17:25 .	4 .	Endurance
KRAILC1C 00000006	0:00:00	NA	0:06:25 .	0:07:25 .	0:17:29 .	4 .	Endurance
KRAILC1C 00000007	0:00:00	NA	0:06:30	0:07:30	0:17:33	4	Endurance
KRAILC1C 00000008	0:00:00	NA	0:06:35	0:07:35	0:17:37	4	Endurance
KRAILC1C 00000009	0:00:00	NA	0:06:40	0:07:40	0:17:41	4	Endurance
KRAILC1C 00000010	0:00:00	NA	0:06:45	0:07:45	0:17:45	4	Endurance
KRAILC1C 00000011	0:00:00	NA	0:06:50	0:07:50	0:17:49	4	Endurance
KRAILC1C 00000012	0:00:00	NA	0:06:55	0:07:55	0:17:53	4	Endurance
KRAILC1C 00000013	0:00:00	NA	0:07:00	0:08:00	0:18:02	4	Endurance
KRAILC1C 00000014	0:00:00	NA	0:07:05	0:08:05	0:18:06	4	Endurance
KRAILC1C 00000015	0:00:00	NA	0:07:10	0:08:10	0:18:10	4	Endurance
KRAILC1C 00000016	0:00:00	NA	0:07:15	0:08:15	0:18:14	4	Endurance
KRAILC1C 00000017	0:00:00	NA	0:07:20	0:08:20	0:18:18	4	Endurance
KRAILC1C 00000018	0:00:00	NA	0:07:25	0:08:25	0:18:22	4	Endurance
KRAILC1C 00000019	0:00:00	NA	0:07:30	0:08:30	0:18:26	4	Endurance
KRAILC1C 00000020	0:00:00	NA	0:07:35	0:08:35	0:18:30	4	Endurance
4a	KRAILC1C 00000021	0:00:00	NA	0:07:40	0:08:40	0:18:34	4 Endurance
	KRAILC1C 00000022	0:00:00	NA	0:07:45	0:08:45	0:18:38	4 Endurance
	KRAILC1C 00000023	0:00:00	NA	0:07:50	0:08:50	0:18:42	4 Endurance
	KRAILC1C 00000024	0:00:00	NA	0:07:55	0:08:55	0:18:46	4 Endurance
	KRAILC1C 00000025	0:00:00	NA	0:08:00	0:09:00	0:18:54	4 Endurance
	KRAILC1C 00000026	0:00:00	NA	0:08:05	0:09:05	0:18:58	4 Endurance
	KRAILC1C 00000027	0:00:00	NA	0:08:10	0:09:10	0:19:02	4 Endurance
	KRAILC1C 00000028	0:00:00	NA	0:08:15	0:09:15	0:19:06	4 Endurance
	KRAILC1C 00000029	0:00:00	NA	0:08:20	0:09:20	0:19:10	4 Endurance
	KRAILC1C 00000030	0:00:00	NA	0:08:25	0:09:25	0:19:14	4 Endurance

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b

KRAILC1C 00000031	0:00:00	NA	0:08:30	0:09:30	0:19:18	4	Endurance
KRAILC1C 00000032	0:00:00	NA	0:08:35	0:09:35	0:19:22	4	Endurance
KRAILC1C 00000033	0:00:00	NA	0:08:40	0:09:40	0:19:26	4	Endurance
KRAILC1C 00000034	0:00:00	NA	0:08:45	0:09:45	0:19:30	4	Endurance
KRAILC1C 00000035	0:00:00	NA	0:08:50	0:09:50	0:19:34	4	Endurance
KRAILC1C 00000036	0:00:00	NA	0:08:55	0:09:55	0:19:38	4	Endurance
KRAILC1C 00000037	0:00:00	NA	0:09:00	0:10:00	0:19:47	4	Endurance
KRAILC1C 00000038	0:00:00	NA	0:09:05	0:10:05	0:19:51	4	Endurance
KRAILC1C 00000039	0:00:00	NA	0:09:10	0:10:10	0:19:55	4	Endurance
KRAILC1C 00000040	0:00:00	NA	0:09:15	0:10:15	0:19:59	4	Endurance
KRAILC1C 00000041	0:05:00	NA	0:13:42	0:14:42	0:20:03	4	Endurance
KRAILC1C 00000042	0:05:00	NA	0:13:47	0:14:47	0:20:07	4	Endurance
KRAILC1C 00000043	0:05:00	NA	0:13:52	0:14:52	0:20:11	4	Endurance
KRAILC1C 00000044	0:05:00	NA	0:13:57	0:14:57	0:20:15	4	Endurance
KRAILC1C 00000045	0:05:00	NA	0:14:02	0:15:02	0:20:19	4	Endurance
KRAILC1C 00000046	0:05:00	NA	0:14:07	0:15:07	0:20:23	4	Endurance
KRAILC1C 00000047	0:05:00	NA	0:14:12	0:15:12	0:20:27	4	Endurance
KRAILC1C 00000048	0:05:00	NA	0:14:17	0:15:17	0:20:31	4	Endurance
KRAILC1C 00000049	0:05:00	NA	0:14:22	0:15:22	0:20:40	4	Endurance
KRAILC1C 00000050	0:05:00	NA	0:14:27	0:15:27	0:20:44	4	Endurance
KRAILC1C 00000051	0:05:00	NA	0:14:32	0:15:32	0:20:48	4	Endurance
KRAILC1C 00000052	0:05:00	NA	0:14:37	0:15:37	0:20:52	4	Endurance
KRAILC1C 00000053	0:05:00	NA	0:14:42	0:15:42	0:20:56	4	Endurance
KRAILC1C 00000054	0:05:00	NA	0:14:47	0:15:47	0:21:00	4	Endurance
KRAILC1C 00000055	0:05:00	NA	0:14:52	0:15:52	0:21:04	4	Endurance
KRAILC1C 00000056	0:05:00	NA	0:14:57	0:15:57	0:21:08	4	Endurance
KRAILC1C 00000057	0:05:00	NA	0:15:02	0:16:02	0:21:12	4	Endurance
KRAILC1C 00000058	0:05:00	NA	0:15:07	0:16:07	0:21:16	4	Endurance
KRAILC1C 00000059	0:05:00	NA	0:15:12	0:16:12	0:21:20	4	Endurance
KRAILC1C 00000060	0:05:00	NA	0:15:17	0:16:17	0:21:24	4	Endurance
KRAILC1C 00000061	0:05:00	NA	0:15:22	0:16:22	0:21:33	4	Endurance
KRAILC1C 00000062	0:05:00	NA	0:15:27	0:16:27	0:21:37	4	Endurance
KRAILC1C 00000063	0:05:00	NA	0:15:32	0:16:32	0:21:41	4	Endurance
KRAILC1C 00000064	0:05:00	NA	0:15:37	0:16:37	0:21:45	4	Endurance
KRAILC1C 00000065	0:05:00	NA	0:15:42	0:16:42	0:21:49	4	Endurance
KRAILC1C 00000066	0:05:00	NA	0:15:47	0:16:47	0:21:53	4	Endurance
KRAILC1C 00000067	0:05:00	NA	0:15:52	0:16:52	0:21:57	4	Endurance

KRAILC1C 00000068	0:05:00	NA	0:15:57	0:16:57	0:22:01	4	Endurance
KRAILC1C 00000069	0:05:00	NA	0:16:02	0:17:02	0:22:05	4	Endurance
KRAILC1C 00000070	0:05:00	NA	0:16:07	0:17:07	0:22:09	4	Endurance
KRAILC1C 00000071	0:05:00	NA	0:16:12	0:17:12	0:22:13	4	Endurance
KRAILC1C 00000072	0:05:00	NA	0:16:17	0:17:17	0:22:17	4	Endurance
KRAILC1C 00000073	0:05:00	NA	0:16:22	0:17:22	0:22:25	4	Endurance
KRAILC1C 00000074	0:05:00	NA	0:16:27	0:17:27	0:22:29	4	Endurance
KRAILC1C 00000075	0:05:00	NA	0:16:32	0:17:32	0:22:33	4	Endurance
KRAILC1C 00000076	0:05:00	NA	0:16:37	0:17:37	0:22:37	4	Endurance
KRAILC1C 00000077	0:05:00	NA	0:16:42	0:17:42	0:22:41	4	Endurance
KRAILC1C 00000078	0:05:00	NA	0:16:47	0:17:47	0:22:45	4	Endurance
KRAILC1C 00000079	0:05:00	NA	0:16:52	0:17:52	0:22:49	4	Endurance
KRAILC1C 00000080	0:05:00	NA	0:16:57	0:17:57	0:22:53	4	Endurance
KRAILC1C 00000081	0:10:00	NA	0:19:44	0:20:44	0:22:57	4	Endurance
KRAILC1C 00000082	0:10:00	NA	0:19:49	0:20:49	0:23:01	4	Endurance
KRAILC1C 00000083	0:10:00	NA	0:19:54	0:20:54	0:23:05	4	Endurance
KRAILC1C 00000084	0:10:00	NA	0:19:59	0:20:59	0:23:09	4	Endurance
KRAILC1C 00000085	0:10:00	NA	0:20:04	0:21:04	0:23:18	4	Endurance
KRAILC1C 00000086	0:10:00	NA	0:20:09	0:21:09	0:23:22	4	Endurance
KRAILC1C 00000087	0:10:00	NA	0:20:14	0:21:14	0:23:26	4	Endurance
KRAILC1C 00000088	0:10:00	NA	0:20:19	0:21:19	0:23:30	4	Endurance
KRAILC1C 00000089	0:10:00	NA	0:20:24	0:21:24	0:23:34	4	Endurance
KRAILC1C 00000090	0:10:00	NA	0:20:29	0:21:29	0:23:38	4	Endurance
KRAILC1C 00000091	0:10:00	NA	0:20:34	0:21:34	0:23:42	4	Endurance
KRAILC1C 00000092	0:10:00	NA	0:20:39	0:21:39	0:23:46	4	Endurance
KRAILC1C 00000093	0:10:00	NA	0:20:44	0:21:44	0:23:50	4	Endurance
KRAILC1C 00000094	0:10:00	NA	0:20:49	0:21:49	0:23:54	4	Endurance
KRAILC1C 00000095	0:10:00	NA	0:20:54	0:21:54	0:23:58	4	Endurance
KRAILC1C 00000096	0:10:00	NA	0:20:59	0:21:59	1:00:02	4	Endurance
KRAILC1C 00000097	0:10:00	NA	0:21:04	0:22:04	1:00:09	4	Endurance
KRAILC1C 00000098	0:10:00	NA	0:21:09	0:22:09	1:00:13	4	Endurance
KRAILC1C 00000099	0:10:00	NA	0:21:14	0:22:14	1:00:17	4	Endurance
KRAILC1C 00000100	0:10:00	NA	0:21:19	0:22:19	1:00:21	4	Endurance

Scenario Name: basecont_rail.rd
 PORTSIM Rail Timing File

LIN ID ^a	TAP	RT1	RT2	RT3	RT4	RT5	RT6	RT7	RT8	RT9	
	Arrived At Port	Arrived At IY	Completed IY Process	Coupled Locomotive At IY	Arrived At Spur	Uncoupled Locomotive At Spur	Removed Tiedown	Discharged From Flatcar	Coupled Locomotive At Spur	Arrived At IY From Spur	
001	0:00:00 TAP ₁	0:00:00 RT1 ₁	0:02:00 RT1 _{1+d}	0:02:13 RT2 _{1+e+f}	0:02:21 RT3 _{1+g}	0:02:31 RT4 _{1+h}	0:02:36 RT5 _{1+i}	0:05:56 RT6 _{40+j}	0:09:24 RT7 _{40+g+k}	0:09:32 RT8 _{1+e}	
002	0:00:00 TAP ₂	0:00:00 RT1 ₂	0:02:00 RT1 _{2+d}	0:02:13 RT2 _{2+e+f}	0:02:21 RT3 _{2+g}	0:02:31 RT4 _{2+h}	0:02:41 ^+i	0:06:01 ^+j	0:09:24 RT7 _{40+g+k}	0:09:32 RT8 _{2+e}	
003	0:00:00 TAP ₃	0:00:00 RT1 ₃	0:02:00 RT1 _{3+d}	0:02:13 RT2 _{3+e+f}	0:02:21 RT3 _{3+g}	0:02:31 RT4 _{3+h}	0:02:46 ^+i	0:06:06 ^+j	0:09:24 RT7 _{40+g+k}	0:09:32 RT8 _{3+e}	
004	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:02:51 .	0:06:11 .	0:09:24 .	0:09:32 .	
005	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:02:56 .	0:06:16 .	0:09:24 .	0:09:32 .	
006	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:01 .	0:06:21 .	0:09:24 .	0:09:32 .	
007	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:06 .	0:06:26 .	0:09:24 .	0:09:32 .	
008	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:11 .	0:06:31 .	0:09:24 .	0:09:32 .	
009	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:16 .	0:06:36 .	0:09:24 .	0:09:32 .	
010	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:21 .	0:06:41 .	0:09:24 .	0:09:32 .	
011	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:26 .	0:06:46 .	0:09:24 .	0:09:32 .	
012	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:31 .	0:06:51 .	0:09:24 .	0:09:32 .	
013	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:36 .	0:06:56 .	0:09:24 .	0:09:32 .	
121	014	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:41 .	0:07:01 .	0:09:24 .	0:09:32 .
	015	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:46 .	0:07:06 .	0:09:24 .	0:09:32 .
	016	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:51 .	0:07:11 .	0:09:24 .	0:09:32 .
	017	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:03:56 .	0:07:16 .	0:09:24 .	0:09:32 .
	018	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:01 .	0:07:21 .	0:09:24 .	0:09:32 .
	019	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:06 .	0:07:26 .	0:09:24 .	0:09:32 .
	020	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:11 .	0:07:31 .	0:09:24 .	0:09:32 .
	021	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:16 .	0:07:36 .	0:09:24 .	0:09:32 .
	022	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:21 .	0:07:41 .	0:09:24 .	0:09:32 .
	023	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:26 .	0:07:46 .	0:09:24 .	0:09:32 .
	024	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:31 .	0:07:51 .	0:09:24 .	0:09:32 .
	025	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:36 .	0:07:56 .	0:09:24 .	0:09:32 .
	026	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:41 .	0:08:01 .	0:09:24 .	0:09:32 .
	027	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:46 .	0:08:06 .	0:09:24 .	0:09:32 .
	028	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:51 .	0:08:11 .	0:09:24 .	0:09:32 .
	029	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:04:56 .	0:08:16 .	0:09:24 .	0:09:32 .
	030	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:05:01 .	0:08:21 .	0:09:24 .	0:09:32 .
	031	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:05:06 .	0:08:26 .	0:09:24 .	0:09:32 .
	032	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:05:11 .	0:08:31 .	0:09:24 .	0:09:32 .
	033	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:05:16 .	0:08:36 .	0:09:24 .	0:09:32 .
	034	0:00:00 .	0:00:00 .	0:02:00 .	0:02:13 .	0:02:21 .	0:02:31 .	0:05:21 .	0:08:41 .	0:09:24 .	0:09:32 .

	035	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:26	0:08:46	0:09:24	0:09:32
	036	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:31	0:08:51	0:09:24	0:09:32
	037	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:36	0:08:56	0:09:24	0:09:32
	038	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:41	0:09:01	0:09:24	0:09:32
	039	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:46	0:09:06	0:09:24	0:09:32
	040	0:00:00	0:00:00	0:02:00	0:02:13	0:02:21	0:02:31	0:05:51	0:09:11	0:09:24	0:09:32
	041	0:05:00	0:05:00	0:07:00	0:09:55 RT10 ₄₀ +e+f	0:10:03	0:10:13	0:10:18 RT5 ₄₁ +i	0:13:38 RT6 ₈₀ +j	0:17:06 RT7 ₈₀ +g+k	0:17:14
	042	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:23 ^+i	0:13:43 ^+j	0:17:06 RT7 ₈₀ +g+k	0:17:14
	043	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:28 ^+i	0:13:48 ^+j	0:17:06 RT7 ₈₀ +g+k	0:17:14
	044	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:33 .	0:13:53 .	0:17:06 .	0:17:14
	045	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:38 .	0:13:58 .	0:17:06 .	0:17:14
	046	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:43 .	0:14:03 .	0:17:06 .	0:17:14
	047	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:48	0:14:08	0:17:06	0:17:14
	048	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:53	0:14:13	0:17:06	0:17:14
	049	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:10:58	0:14:18	0:17:06	0:17:14
	050	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:03	0:14:23	0:17:06	0:17:14
	051	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:08	0:14:28	0:17:06	0:17:14
	052	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:13	0:14:33	0:17:06	0:17:14
	053	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:18	0:14:38	0:17:06	0:17:14
	054	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:23	0:14:43	0:17:06	0:17:14
122	055	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:28	0:14:48	0:17:06	0:17:14
	056	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:33	0:14:53	0:17:06	0:17:14
	057	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:38	0:14:58	0:17:06	0:17:14
	058	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:43	0:15:03	0:17:06	0:17:14
	059	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:48	0:15:08	0:17:06	0:17:14
	060	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:53	0:15:13	0:17:06	0:17:14
	061	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:11:58	0:15:18	0:17:06	0:17:14
	062	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:03	0:15:23	0:17:06	0:17:14
	063	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:08	0:15:28	0:17:06	0:17:14
	064	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:13	0:15:33	0:17:06	0:17:14
	065	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:18	0:15:38	0:17:06	0:17:14
	066	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:23	0:15:43	0:17:06	0:17:14
	067	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:28	0:15:48	0:17:06	0:17:14
	068	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:33	0:15:53	0:17:06	0:17:14
	069	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:38	0:15:58	0:17:06	0:17:14
	070	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:43	0:16:03	0:17:06	0:17:14
	071	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:48	0:16:08	0:17:06	0:17:14
	072	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:53	0:16:13	0:17:06	0:17:14
	073	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:12:58	0:16:18	0:17:06	0:17:14
	074	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:03	0:16:23	0:17:06	0:17:14
	075	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:08	0:16:28	0:17:06	0:17:14

	076	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:13	0:16:33	0:17:06	0:17:14				
	077	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:18	0:16:38	0:17:06	0:17:14				
	078	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:23	0:16:43	0:17:06	0:17:14				
	079	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:28	0:16:48	0:17:06	0:17:14				
	080	0:05:00	0:05:00	0:07:00	0:09:55	0:10:03	0:10:13	0:13:33	0:16:53	0:17:06	0:17:14				
123	081	0:10:00	0:10:00	0:12:00	0:17:37	RT10 _{80+e+f}	0:17:45	0:17:55	0:18:00	RT5 _{81+i}	0:19:40	RT6 _{100+j}	0:21:28	RT7 _{100+g+k}	0:21:36
	082	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:05	^+i	0:19:45	^+j	0:21:28	RT7 _{100+g+k}	0:21:36	
	083	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:10	^+i	0:19:50	^+j	0:21:28	RT7 _{100+g+k}	0:21:36	
	084	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:15	.	0:19:55	.	0:21:28	.	0:21:36	
	085	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:20	.	0:20:00	.	0:21:28	.	0:21:36	
	086	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:25	.	0:20:05	.	0:21:28	.	0:21:36	
	087	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:30	0:20:10	0:20:10	0:21:28	0:21:36			
	088	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:35	0:20:15	0:20:15	0:21:28	0:21:36			
	089	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:40	0:20:20	0:20:20	0:21:28	0:21:36			
	090	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:45	0:20:25	0:20:25	0:21:28	0:21:36			
	091	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:50	0:20:30	0:20:30	0:21:28	0:21:36			
	092	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:18:55	0:20:35	0:20:35	0:21:28	0:21:36			
	093	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:00	0:20:40	0:20:40	0:21:28	0:21:36			
	094	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:05	0:20:45	0:20:45	0:21:28	0:21:36			
	095	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:10	0:20:50	0:20:50	0:21:28	0:21:36			
	096	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:15	0:20:55	0:21:28	0:21:36				
	097	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:20	0:21:00	0:21:28	0:21:36				
	098	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:25	0:21:05	0:21:28	0:21:36				
	099	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:30	0:21:10	0:21:28	0:21:36				
	100	0:10:00	0:10:00	0:12:00	0:17:37	0:17:45	0:17:55	0:19:35	0:21:15	0:21:28	0:21:36				

a This is an abbreviated LIN ID. The complete LIN ID is preceded by KRAILC1C00000 for each entry.

RT10

Uncoupled
Locomotive
At IY

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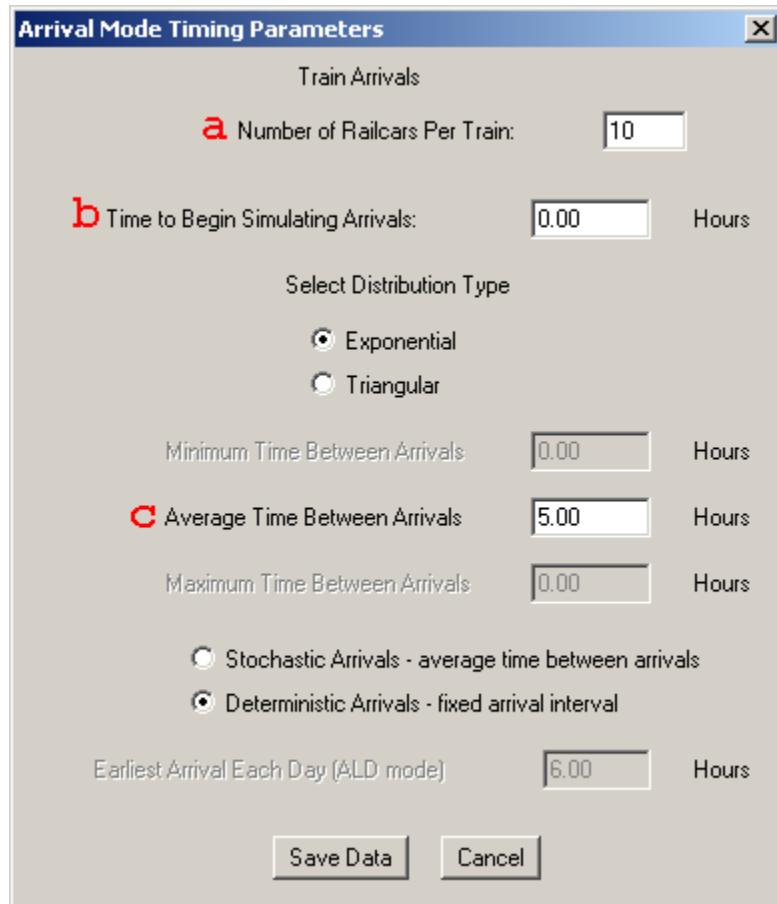
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3.2.6.4 Screen Captures of Input Windows for Containers via Flatcars

This section includes the screen captures of the input windows of those inputs used to compute the Cargo Report and Rail Timing File for the **basecont_rail.rd** scenario. The inputs are identified by the letters a...t, which also correspond to labels used in the equations presented in Section 3.2.6.2.



Process Timing Parameters

RAIL

	TIME	ONE HALF RANGE (+/-)
	Minutes	Minutes
d Processing at Interchange Yard:	120.00	0.00
f Couple at Interchange Yard:	5.00	0.00
g Switch Interchange Yard To Spur:	8.00	0.00
Switch Interchange Yard To Berth:	8.00	0.00
Switch Interchange Yard To Dock:	8.00	0.00
h Uncouple At Spur:	10.00	0.00
i Remove Flatcar Tiedowns:	5.00	0.00
Discharge Vehicle Using End Ramp:	3.00	0.00
Discharge Vehicle Using Crane:	5.00	0.00
j Discharge Container At Spur:	5.00	0.00
k Couple At Spur:	5.00	0.00
e Switch Spur To Interchange Yard:	8.00	0.00
Switch Berth To Interchange Yard:	9.00	0.00
Switch Dock To Interchange Yard:	8.00	0.00
l Uncouple At Interchange Yard:	10.00	0.00

OK **Cancel**

Process Timing Parameters

CONTAINERS

	TIME	ONE HALF RANGE (+/-)
	Minutes	Minutes
m Open Staging Parking:	4.00	0.00
r Transit Container To Berth:	2.00	0.00

OK **Cancel**

Process Timing Parameters X

Cargo Open Staging Dwell Times

Dwell Time 1/2 Range (+/-)

	Mins	Mins
Vehicles:	60.00	0.00
<input checked="" type="radio"/> Containers:	60.00	0.00
Helicopters:	240.00	0.00
Watercraft:	300.00	0.00
Residual Equipment:	180.00	0.00
Pallets:	0.00	0.00

OK **Cancel**

Ship Parameters

X

Ship:	1	Of	1
Ship Name:	Endurance	Stow Factor:	<input type="text" value="0.75"/>
Generic Type:	Container	Trip Number:	<input type="text" value="1"/>
Class:	Container	Length (ft):	<input type="text" value="595"/>
Beam (ft):	103	Draft (ft):	<input type="text" value="34"/>

Maximum Capacities By Cargo Type (Sq. Ft.):

RORO:	<input type="text" value="0"/>	Container:	<input type="text" value="308480"/>	Breakbulk:	<input type="text" value="0"/>
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Self Sustaining:

Ship Accepts:

Vehicles Containers Pallets Helicopters Residual Equipment Watercraft

Cargo Loading Times

	Loading Time		1/2 Range (+/-)			Loading Time		1/2 Range (+/-)	
	Mins		Mins			Mins		Mins	
Vehicles (RORO)	<input type="text" value="4.00"/>		<input type="text" value="0.00"/>		Helicopters	<input type="text" value="150.00"/>		<input type="text" value="0.00"/>	
Vehicles (LOLO)	<input type="text" value="12.00"/>		<input type="text" value="0.00"/>		Watercraft	<input type="text" value="360.00"/>		<input type="text" value="0.00"/>	
S Containers	<input type="text" value="4.00"/>		<input type="text" value="0.00"/>		Residual Equipment	<input type="text" value="120.00"/>		<input type="text" value="0.00"/>	
Pallets	<input type="text" value="0.00"/>		<input type="text" value="0.00"/>						

*** NOTE: Ship Loading Times Global Editor Available Under
Modify Process Timing Parameters Menu Item

> Maximum Wait Without Loading Before Departing **P** Ship Arrival Time To Port In Hours
(User Specifies Exact Arrival Time Mode)

User Specified Berth Assignment

Available	Selected
<input type="button" value="Add ->"/>	<input type="button" value="Priority Implied By Order"/>
<input type="button" value="<- Remove"/>	



Berth Detailed Parameters

Berth Name: Berth 4 Berth: 4 Of 7

Length (ft):	1200	Number of Cranes:	1
Depth Alongside At Mean Low Water (ft):	42	Maximum Call Forward:	12
Deck Strength (psf):	1000	Deck Construction:	Concrete
Apron Width (ft):	110	Fendering:	Timber
Apron Length Served By Rail (ft):	1200		
Apron Height Above Mean Low Water (ft):	15		
Previous Contiguous Berth:	NA		
Next Contiguous Berth:	Berth 5		

Available For Military Use

Accepts the Following Types of Ships:

RORO Container Breakbulk Barge

Previous Berth Next Berth

Save Data Done

This dialog box is titled 'Berth Detailed Parameters' and shows details for Berth 4. It includes fields for length (1200 ft), depth (42 ft), number of cranes (1), deck strength (1000 psf), apron width (110 ft), apron height (15 ft), and construction material (Concrete). It also lists adjacent berths (NA before, Berth 5 after) and accepts RORO, Container, Breakbulk, and Barge types. Buttons for saving data and exiting are at the bottom.

3.2.6.5 PORTSIM Menu Inputs for Containers via Flatcars

This section describes the menu choices/paths to the windows for entering input values. These inputs are used in computing the Cargo Report and the Rail Timing File for the **basecont_rail.rd** scenario (and, in general, for containers via flatcars loaded to ship). The order starts with the Time Arrived at Port, which is common to both the Cargo Report and the Rail Timing File, followed by the Time Cleared Gate from the Cargo Report. The order then follows the ten timing data (left to right) from the Rail Timing File and picks up with the last four timing data (left to right) from the Cargo Report (i.e., Time Parked in Staging through the Loading Time). The Cargo Report entries are shaded in gray. The letters a...t are labels for the input variables as shown in the screen captures (Section 3.2.6.4).

Time Arrived at Port

Parameters > Modify Arrival Mode Timing Parameters > Trains

Number of Railcars per Train = a

Time to Begin Simulating Arrivals = b

Average Time Between Arrivals = c

Time Cleared Gate = TCG

Trains arrive at port and proceed directly to the interchange yard, bypassing any gate processing. For this reason, the TCG column contains NA (not applicable) entries.

Arrived at Interchange Yard

Parameters > Modify Arrival Mode Timing Parameters > Trains

Number of Railcars per Train = a

Time to Begin Simulating Arrivals = b

Average Time Between Arrivals = c

Completed Interchange Yard Process

Parameters > Modify Process Timing Parameters > Railcar

Processing at Interchange Yard = d

Coupled Locomotive at Interchange Yard

Parameters > Modify Process Timing Parameters > Railcar

Switch Spur to Interchange Yard = e

Couple at Interchange Yard = f

Arrived at Spur

Parameters > Modify Process Timing Parameters > Railcar

Switch Interchange Yard to Spur = g

Uncoupled Locomotive at Spur

Parameters > Modify Process Timing Parameters > Railcar
Uncouple at Spur = h

Removed Tiedown

Parameters > Modify Process Timing Parameters > Railcar
Remove Flatcar Tiedowns = i

Discharged from Flatcar

Parameters > Modify Process Timing Parameters > Railcar
Discharge Container at Spur = j

Coupled Locomotive at Spur

Parameters > Modify Process Timing Parameters > Railcar
Switch Interchange Yard to Spur = g
Couple at Spur = k

Arrived at Interchange Yard from Spur

Parameters > Modify Process Timing Parameters > Railcar
Switch Spur to Interchange Yard = e

Uncoupled Locomotive at Interchange Yard

Parameters > Modify Process Timing Parameters > Railcar
Uncouple at Interchange Yard = l

Time Parked in Staging

Parameters > Modify Process Timing Parameters > Container
Open Staging Parking = m

Time Available to Load

Parameters > Modify Process Timing Parameters > Cargo Open Staging Dwell Times
Cargo Open Staging Dwell Times (Containers) = o

Time Loaded

Parameters > Modify Ship Parameters
Ship Arrival Time to Port = p
Cargo Loading Times (Containers) = s

Parameters > Modify Process Timing Parameters > Ship
Ship Berthing Time = q

Parameters > Modify Process Timing Parameters > Container
Transit Container to Berth = r

Parameters > Modify Port Parameters > Berth Parameters
Maximum Call Forward = t

Loading Time

Parameters > Modify Ship Parameters
Cargo Loading Times (Containers) = s

3.3 PROBLEM RESOLUTIONS

Each verification study presented an opportunity to improve and debug PORTSIM. For each study, debugging was an iterative process whose end result provided confirmation of the fundamental accuracy of the Cargo Report and Rail Timing File. Because the verification process spanned all PORTSIM versions from 3.61 to 4.4, each version benefited from debugging through the verification process.

4 CONCLUSIONS

4.1 VALUE ADDED

The verification efforts have added greater levels of quality, confidence, and usefulness to PORTSIM. Further, these efforts have improved the model and user interface, and uncovered and corrected numerous bugs and anomalies. Verification provided insights into model behaviors and relationships — all of which is documented in the six interim reports and compiled in this summary report. In addition, a comprehensive user's manual, *PORTSIM v.4.3: User's Manual*, was produced through these efforts and the *Deterministic and Stochastic Options for PORTSIM* was written to assist the user. An update to the *Deterministic and Stochastic Options for PORTSIM* report was included with Appendix A of the *PORTSIM v.4.3: User's Manual*. Collectively, all of these products and software improvements provide major benefits for the users.

4.2 FUTURE DIRECTIONS

Suggested future tasks for PORTSIM 4 include the following:

- Verifying stochastic model components (arrival mode timing parameters, process timing parameters, etc.);
- Continuing to verify recent printing module upgrades;
- Verifying the remaining model reports, tables, and graphs (other than Cargo Report and Rail Timing Report, which have already been verified for each cargo-transport combination); and
- Testing larger scenarios for correct cargo sequencing and queuing.

In addition, it is recommended that verification tasks be conducted in parallel with the development of PORTSIM 5. Lessons learned during the PORTSIM 4 verification efforts provide motivation and foundation for:

- Conducting verification during the development phase to minimize the impact of potential problems on other design features or implementations,
- Enhancing reports and graphs to improve depiction of wait times and other schedule-oriented features,
- Minimizing the post-model development requirements for verification and debugging,
- Providing general guidance for user-based model design and functionality features,

- Reviewing and verifying the debarkation logic and functionality,
- Structuring PORTSIM 5 reports and graphs to facilitate verification tasks, and
- Developing thorough and consistent documentation (user manual) in parallel with model development as a further aid in model testing and verification (Davidson et al., 2002).

The experience and mechanisms for conducting thorough verifications have been established and are ready for further application.

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